The FOUNDRY
December 1917
CLEVELAND, OHIO.
Vol. 45, No. 12 Whole No. 304

Agreed Prices and Their Meaning to Foundrymen

Influence of Labor on Cost of Castings Complicates Problem of Price Fixing—Rates on Old Material Prove Distinct Surprise

FOLLOWING the establishment of prices on pig iron, coke and a limited number of grades of scrap, the revision of gray and malleable iron, steel and nonferrous metal casting prices to conform to these schedules is to be discussed. Owing to the large number of plants involved and the variety of patterns to be considered, the undertaking is a stupendous one, yet it is not without the possibility of accomplishment. The problem is unlike that of any other industry in which price price control has become effective. Contrasting the manufacture of castings with that of pig iron and rolled iron and steel products, the labor factor is of major importance in the one and is a minor element in the other. On the average casting, the labor involved, to a large extent, governs the price and the metal entering into it, with the exception of brass, bronze and aluminum, is actually of minor importance. Therefore, in considering the question of price establishment in the foundry industry, labor is the item of first importance. That an equitable basis will be evolved that can be made to apply to all branches of castings manufacture is certain, and when this has been decided upon the work of price revision will be greatly simplified.

Foundry Iron, Scrap and Coke Prices

FOUNDRY PIG IRON

	Gross ton at furnaces
No. 2, Silicon, 1.75 to 2.25	$33.00
Malleable	33.50
Bessemer	36.30
Basic	33.00
Lake Superior charcoal, Si. 1.25	35.50
Silvery, Si. 6 per cent.	40.00
Low phosphorus, copper bearing	50.00
Low phosphorus, copper free	53.00

OLD MATERIAL

	Gross ton, f. o. b. consuming point
No. 1 heavy melting steel	$30.00
No. 1 railroad wrought	35.00
Cast iron borings	20.00
Machine shop turnings	20.00

COKE

	At the ovens
Beehive	$7.00

On Friday, Nov. 16, a meeting of the open-hearth, converter, crucible and electric steel casting manufacturers was held in the Waldorf-Astoria, New York, for the purpose of adopting a method of procedure in establishing prices to conform with the agreed quotations on pig iron and steel products. More than 100 foundrymen were in attendance and the expressions of aid and support to the government, in whatever form the request might be made, were unanimous. A resolution was adopted pledging the steel casting plants of the country and their output, their organizations, etc., to the government. For the purpose of co-operating with the general committee of the American Iron and Steel institute in establishing prices on steel castings, the following committee was appointed:

Chairman, G. H. Johnson, Isaac G. Johnson & Co., New York; E. S. Knisely, Bethlehem Steel Co., South Bethlehem, Pa.; H. D. Hammond, American Steel Foundries, Chicage; H. E. Field, Wheeling Mold & Foundry Co., Wheeling, W. Va.; S. P. Bush, Buckeye Steel Castings Co., Columbus, O.; I. W. Frank, United Engineering & Foundry Co., Pittsburgh, and H. J. Koch, Fort Pitt Steel Casting Co., McKeesport, Pa.

Owing to the large number of individual plants in the gray iron and nonferrous branches of the industry, the problem of price revision from the point of contact with these producers will be difficult. A general meeting of gray iron foundrymen, representing more than 4000 shops in the United States, is not possible and the brass manufacturers, 2000 strong, could hardly air their views in open meeting. The situation in the malleable and steel casting industries is different, since the total number of plants in each is limited to slightly more than

200. What method of procedure will be followed in the gray iron and nonferrous branches of the trade has not yet been decided upon, although it is certain that the work will have to be done by representative committees.

At the recent annual meeting of the American Foundrymen's association a war service board, consisting of five members was authorized, which should represent the gray and malleable iron, steel and nonferrous branches of the casting trade. This board has been appointed by Benj. D. Fuller, president of this organization, and is constituted as follows: R. A. Bull, chairman, Duquesne Steel Foundry Co., Pittsburgh; J. C. Haswell, Dayton Malleable Iron Co., Dayton, O.; C. C. Smith, Union Steel Casting Co., Pittsburgh; H. D. Miles, Buffalo Foundry & Machine Co., Buffalo and G. H. Clamer, Ajax Metal Co., Philadelphia. The resolution authorizing this board provided that its membership be representative of the casting industry of the United States, without reference to affiliation with any organization and how well the intent of the resolution has been carried out is indicated by the affiliation of its members with the American Foundrymen's association, National Founders' association, American Institute of Metals, American Malleable Castings association and the Steel Founders' society. Since this board is intended to form a point of contact between the government and the foundry industry of the country in securing castings of proper quality at desired rates of production, at fair prices, etc., many subcommittee undoubtedly will be appointed to represent the various specialized lines of each branch of the casting trade.

Of further interest to foundrymen is the schedule of differentials for various grades of pig iron figured upon the base price of $33, furnace, for No. 2 foundry and basic iron. This announcement has clarified the situation and is published in full in one of the accompanying tables. It should be noted that the base price for No. 2 foundry iron is $33, furnace, regardless of where the producing plant is located. Therefore, the differentials that have existed on southern iron and which represented the freight rate to the Ohio river have been wiped out entirely. The natural tendency of pig iron purchases, therefore, will be in the direction of lowest freight rate and the distantly located stacks will be the recipients of tonnages only when the nearby furnaces are unable to make deliveries. How this will work out in the great southern iron producing district only can be conjectured, but in periods of limited demand, it is certain that these furnaces will absorb the necessary freight to enable them to compete with northern furnaces.

Throughout the year the scarcity of coke and the high prices that have been prevailing for this fuel, have made foundry operation unusually difficult. While prices were established some time ago on furnace coke at $6 a ton, only recently were agreed prices announced for foundry coke on the basis of $7 a ton, bee-hive ovens. At the time this is being written, by-product coke quotations have not been decided upon, although it has been recommended that the prices at the various by-products plants be the $7 price for bee-hive coke plus the freight rate from the by-product plant to the nearest bee-hive oven works. Since coke prices have been agreed upon, foundrymen are disturbed over their inability to purchase either spot coke or fuel on contract at established prices. From the standpoint of the cokemaker, it is inadvisable for him to take long-time contracts, particularly in view of the persistent rumors that there may be an upward revision about the first of the year. The scarcity of spot coke is attributed to the car shortage and producers are unable to secure sufficient equipment for their regular trade. The railroad question is, of course, the most vital problem demanding solution in connection with the foundry fuel shortage and it is doubtful if conditions will improve this winter.

Government prices on old material come as a distinct surprise to the trade. The grades on which quotations have been agreed upon include cast iron borings, machine shop turnings, No. 1 railroad wrought and No. 1 heavy melting steel. Furthermore, the maximum prices announced, in every instance are in excess of the quotations prevailing in the various important scrap markets. No. 1 heavy melting steel has been fixed at $30 per ton, consuming point, whereas quotations prior to the announcement of this price did not exceed $28, and at Birmingham this material could be secured as low as $20. No. 1 railroad wrought was fixed at $35 and cast iron borings and machine shop turnings at $20. All of these prices are based

Agreed Pig Iron Prices

Foundry Grades

Silicon, per cent	Gross ton furnace
1.00 to 1.75	32.50
1.75 to 2.25	$33.00
2.25 to 2.75	33.50
2.75 to 3.25	34.50
3.25 to 3.75	35.50

Add $1 for each 0.50 per cent increase in silicon

Other Foundry Grades

Malleable	$33.50
Bessemer	36.30
Basic	33.00
Southern or warm blast charcoal	43.00
Cold blast charcoal	[illegible]
Lake Superior charcoal, 1.25 Si	50.50
Low phosphorus, copper bearing	50.00
Low phosphorus, copper free	53.00
Silvery iron, 6 per cent Si	40.00
Silvery iron, 8 per cent Si	44.50
Silvery iron, 10 per cent Si	50.00
Bessemer ferrosilicon, 10 per cent Si	55.00

Lake Superior Charcoal Iron Differentials

Silicon, per cent	
1.50	$36.00
1.75	36.50
2.00	37.00
2.25	37.50
2.50	38.00
2.75	38.50
3.00	39.00

on gross tons, f.o.b. consuming point. Basing these prices uniformly on a gross ton schedule is the forerunner of uniform practice along this line and ultimately will lead to the elimination of net prices for old materials, thereby making the sale weight uniform in all markets. In the announcement of pig iron differentials, grades have been eliminated entirely and the schedule is based on the silicon, sulphur, phosphorus and manganese content. This will give added impetus to the purchase of iron on chemical content only and hurries the day when grades and fractures are consigned to the discard. Although the bulk of the pig iron tonnage in recent years has been bought on analysis only, nevertheless, many foundrymen have adhered to the archaic practice of specifying grade and many still place their dependence upon fracture. The only reference to grade in this announcement is to No. 2 foundry iron which should be equivalent in analysis to an iron containing 1.75 to 2.25 per cent silicon and not over 0.05 per cent sulphur. The remainder of the differentials are on analysis basis and the agreed prices will compel purchases to be made on chemical content only.

Probably the most disturbing factor that has been introduced into the situation is the implied suggestion of the possibility of the abrogation of existing contracts. In a questionaire sent to the manufacturers of iron and steel by the federal trade commission, inquiry was made for opinions on this subject. While it may seem to be the proper course of procedure to the foundryman who is covered far into the future for pig iron at prices greatly in excess of those agreed upon, nevertheless he must not overlook the fact that the abrogation of contracts will be far-reaching in its effect and will apply equally to the casting orders on his books based on high market quotations, and these would have to be revised downward if this action were taken. On the other hand, the foundryman who still has a large tonnage of low priced iron coming to him on uncompleted contracts hardly would care to have these cancelled and the agreed prices substituted therefor.

Regardless of the foregoing considerations which might be characterized as selfish, a moral question of great magnitude is involved. If our government sanctions a practice that has been held illegal by our courts and which has consistently been frowned upon by the trade, what will the future hold in store for the American business man in his contractural relations? The violation of the treaty with Belgium is the most noted contract-breaking episode in history and the adoption of a contract abrogation policy would be our favorable endorsement of this heinous offense. In the iron and steel industry, other than the casting trade, 42 agreed price schedules already have been issued and the American Iron and Steel institute committee will issue at least 30 more.

Recommended Differentials

By agreement between the general committee on steel and steel products of the American Iron and Steel institute, and the war industries board, approved by the President, the base price of No. 2 foundry iron and also of basic iron was fixed at $33 per gross ton, f. o. b. cars, furnace. From these base prices, the sub-committee on pig iron, iron ore and lake transportation has reported to the general committee a list of differentials which the general committee believes is fair and reasonable and in accordance with the usages of the trade, and therefore recommends to the iron industry that the same be adopted to take effect immediately. It is hoped there will be no hesitancy in accepting this recommendation. The list follows:

The grade of No. 2 foundry iron to be equivalent in analysis to:

Silicon	1.75 to 2.25
Sulphur	Not over .05

No. 2 soft southern iron equivalent to No. 2 foundry of same silicon content.

Differentials from the above base price for No. 2 foundry iron to be made for the following changes in specifications:

	Per gross ton
Forge or mill iron	$1.00 under base
Foundry iron running silicon 1.00 to 1.75—	.50 under base
Foundry iron running silicon 2.25 to 2.75—	.50 over base
Foundry iron running silicon 2.75 to 3.25—	1.50 over base

Foundry iron in excess of 3.25 silicon, add $1.00 per gross ton for each ½ per cent of silicon over the price for 3.25 silicon iron.

Manganese, sulphur and phosphorus variations to be adjusted as formerly customary in each district having respect to the base price.

Where iron is sold by fracture, the usual grading prevailing in each district to continue:

Malleable iron	$0.50 per gross ton above base
Bessemer iron	10 per cent per gross ton above base
Basic iron	Base price

CHARCOAL IRON

Southern or warm blast charcoal iron, a maximum of $10.00 per gross ton above base for iron ranging 0.40 to 0.60 phosphorus, and silicon 1.00 to 2.00.

For grades running below these analyses, corresponding reductions as usual to the trade to be made.

Cold blast charcoal iron, a maximum of $22.00 per gross ton above base with customary reductions for lower grades, as recognized by the trade.

Lake Superior iron, $2.50 per gross ton above base for iron averaging 1.25 silicon. Other grades to be adjusted as per the custom of the trade depending upon the silicon, phosphorus and manganese contents of the iron.

All of these charcoal iron differentials to be considered in connection with the base price.

HIGH SILICON OR SILVERY IRON

For iron containing:

6 per cent silicon	$7.00 per gross ton above base
7 per cent silicon	9.00 per gross ton above base
8 per cent silicon	11.50 per gross ton above base
9 per cent silicon	14.00 per gross ton above base
10 per cent silicon	17.00 per gross ton above base

$3.00 per gross ton advance for each 1 per cent silicon for 11 per cent and over.

BESSEMER FERROSILICON

For iron containing:

10 per cent silicon	$22.00 per gross ton above base
11 per cent silicon	25.30 per gross ton above base
12 per cent silicon	28.60 per gross ton above base

LOW PHOSPHORUS IRON

Iron containing phosphorus and sulphur not exceeding 0.04, and silicon not exceeding 2 per cent:

For copper bearing iron	$17.00 per gross ton above base
For copper free iron	20.00 per gross ton above base

A sliding scale of $1.50 per gross ton advance for each reduction in phosphorus of 0.005 per cent below 0.04 and $1.75 per gross ton advance for each 1 per cent of silicon in excess of 2 per cent.

Furnace for Melting Copper-Zinc Alloys

New Induction Unit Recently Developed by Philadelphia Company, Designed Primarily for Utilization in Rolling Mills

THE Ajax Metal Co., Philadelphia, which is building the Ajax-Wyatt electric furnace for melting copper-zinc alloys has designed the furnace principally with a view toward its utilization in rolling mills. Like the Schneider furnace, the Ajax-Wyatt is of the closed-channel induction type, so that when it is operating, a pool of molten metal exerts an hydraulic pressure upon that metal in the closed channel. This channel constitutes the secondary loop of the current path. Heat is generated in the channel because of the restricted cross-section and the consequently higher resistance. Motor effect in causing circulation is set up at the acute angle of the V-shaped channel, which is located at the lower extremity of the furnace and communicates with the main body of the furnace through the ends of the diverging arms of the V.

Consisting of the body, the channel portion and a transformer, the furnace unit is built to be rotated about trunnions. The furnace body, which is adapted to receive a pool of molten metal and melt the pieces of metal down into it, consists of a lined steel jacket fitted with a spout. In this type of construction, the transformer is interposed between the body of the furnace and the casing within which the lower part of the channel is built. In this way a shell type of transformer is built into the unit and forms part of the frame of the complete furnace. This, it is claimed, reduces the number of metal parts, avoids interruptions of the magnetic circuit and reduces heat losses.

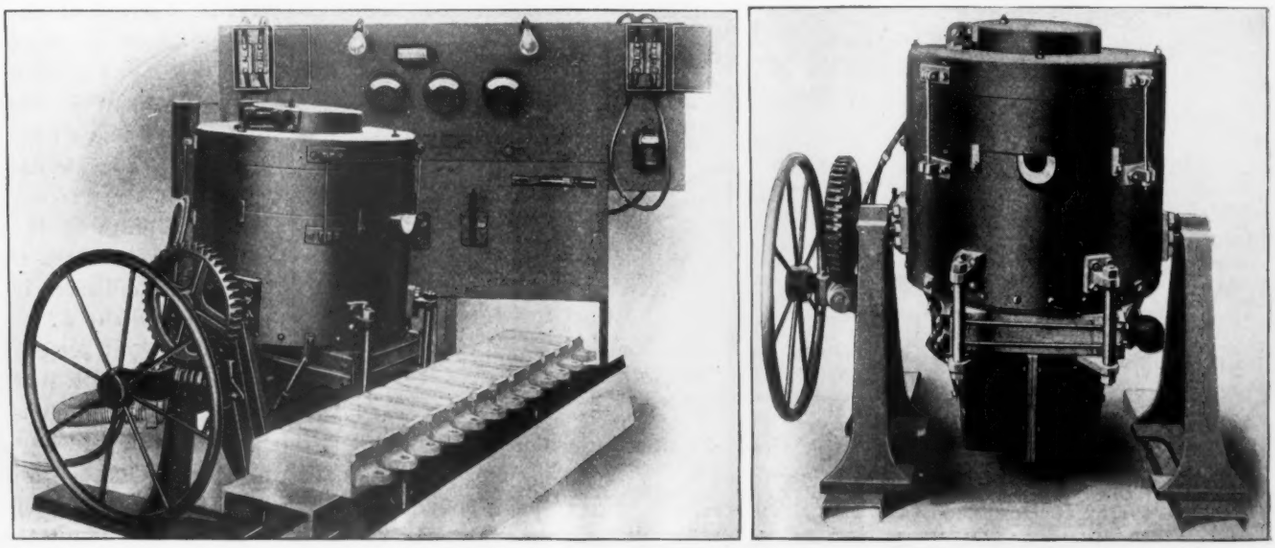
The transformer is of the single-phase shell type. The channel is rectangular in cross-section and at its extremity forms an acute angle. At the point where the channel communicates with the pool, acute angles are avoided. The channel ends meet the pool in a generally vertical direction at the outer edges of the pool and on opposite sides, thus enabling a stirring action to be exerted upon the liquid in the pool when circulation through the channel is set up. When electric currents traverse fluid conductors and flow in opposite directions, electro-dynamic forces are set up in the connectors in directions perpendicular to the lengths of the conductors and these tend to repel each other. If the conductors are not parallel, corresponding hydrodynamic forces tending to produce motion of the fluid parallel to the conductor are set up. This phenomenon is what is known as *motor effect,* and in the Ajax-Wyatt electric furnace causes motion of the molten metal and hence circulation. Although *Joule effect* and *pinch effect* also are present, *motor effect* is said to be of prime importance in starting and maintaining circulation of the metal.

Rapid charging of this type of furnace incurs no possibility of the metal solidifying in the secondary channels, or in the lower portion of the pool, it is said, the only precaution necessary being to exercise care in preventing the bridging of the charge. The furnace may be tightly sealed, as the forces which act in the channel are asserted to have the ability to carry the heated metal upward and thus bring it in contact with the metal to be melted.

At present the furnace is made in two sizes with ratings of 30 and 60 kilowatts, respectively, and designed to operate with single-phase, 60-cycle, 220-volt current. The power factor of the 30-kilowatt furnace is 85 per cent and of the 60-kilowatt furnace, 72 per cent. The load factor approaches 100 per cent. For starting, the smaller furnace requires a 75-pound starting charge while the larger unit requires a charge of 125 pounds. The smaller unit pours 300 pounds in one heat, while the large unit pours 600 pounds. Melting rates of the two furnaces are 6½ to 9 pounds per kilowatt-hour for the smaller unit and 7½ to 11 pounds per kilowatt-hour for the larger unit; the lower figures were obtained when a 70-30 alloy was melted in the form of bulky turnings, while the higher were obtained with extrusion metal consisting of a 60-40 alloy—the usual rolling mill mixture. The temperature of the cast metal averages about 2000 degrees Fahr.

This furnace, in its present stage of development, is intended only for melting copper-zinc alloys carrying not more than 3 per cent of lead. When once started, it is necessary to keep the furnace in continuous opera-

(*Concluded on Page* 547)



TWO VIEWS OF INDUCTION FURNACE DEVELOPED BY AJAX METAL CO., PHILADELPHIA

Organizing a Malleable Iron Foundry in 90 Days

How Richmond, Ind., Foundrymen Overcame Difficulties Imposed by an Inadequate Supply of Labor and Poor Delivery of Building Materials

THIS is a true story. If it proves to be stranger than fiction, it is because American ingenuity has been compelled to go to great lengths in order to solve the complex problems of present-day industrial activity. The scene is Richmond, Ind., and the principal characters are four men who decided in 1916 to operate a malleable foundry.

In arriving at this decision, the four men took into account the unusual conditions prevailing at the time. It was clearly evident that the unusual demand for castings was far in excess of the existing productive capacity of foundries. The same activities which stimulated the demand for castings had the effect of slowing-up deliveries of other kinds of material. This feature of the situation made it necessary to devise ways and means of securing equipment in the shortest possible time and if the proprietors were to enjoy the benefits of the existing high markets, they could ill afford to lose time in getting the new foundry under way.

Utilize Tractor Plant

Therefore, when the question of building was considered, they eliminated the possibility of erecting a new foundry, and promptly decided to purchase a plant already built which would be suitable for their purpose. After investigating a number of factory buildings, they chose one which had formerly been used for making agricultural tractors. This plant was situated near the business district of Richmond, Ind., on the main line of the Pennsylvania railroad. It consisted essentially af a large brick and wood building of mill construction, having a high roof, and was unusually well lighted by large areas of sash in the side walls and cupola. Most of the sash in the cupola were pivoted, thereby affording good ventilation. This large building appeared to fulfill the requirements of a model molding room for a malleable foundry.

The deal by which the old tractor plant was acquired was negotiated Nov. 1, 1916. Two of the four men, who had been associated with one of the largest manufacturers of malleable castings in the United States, immediately assumed the task of putting the building in shape for foundry purposes. They found it necessary to tear up the floor in the main building, to install an automatic sprinkler system throughout the plant, to make a number of alterations in the roof construction of the main building, and to build a structure adjacent to this building to house the annealing ovens and core room.

In general, it was not necessary to make any radical changes in the large building which was to be used for the foundry proper. As shown in Fig. 1, which is a view of part of the molding floor, it was only necessary to install the wood stalls separating the molding floors. These are clearly shown in the illustration. Each molding floor was equipped with a hand squeezer made by the B. & B. Mfg. Co., Indianapolis, and snap flasks made by the Diamond Clamp & Flask Co., Richmond, Ind. The entire plant was then piped for compressed air and water. The air lines were supplied with air at a pressure of from 60 to 65 pounds per square inch by a Chicago Pneumatic Tool Co. air compressor situated in the southeast corner of the building.

The 10-Ton Furnaces

It was found necessary to make slight alterations in the building to accommodate the melting equipment. Profiting by their experience with the large manufacturer of malleable castings, the two men designed a type of 10-ton air furnace best adapted to their purpose. One of these units is shown in Fig. 2. Each furnace is essentially of the approved design commonly employed in malleable foundries, but is of unusually substantial construction. Brickwork is encased in heavy castings held in place by vertical steel rails anchored in the ground. The blast enters the furnace through five nozzles connected to a blast pipe which passes underneath the molding floor, thereby overcoming the objection of having an overhead pipe obstructing the headway over the furnace. A centrifugal blower manufactured by the Clarage Fan Co., Kalamazoo, Mich.,

FIG. 1—VIEW OF THE MOLDING FLOOR IN THE RICHMOND MALLEABLE CASTING CO.'S PLANT, RICHMOND, IND.

FIG. 2—ONE OF THE TWO 10-TON AIR FURNACES—THE BLAST PIPE EXTENDS UNDERGROUND FROM BLOWER TO FURNACE

provides blast for each 10-ton furnace. These fans are driven by individual 10-horsepower, 60-cycle, 3-phase motors, made by the General Electric Co., Schenectady, N. Y.

With the exception of the two double bungs, each bung is made of a single re-inforcing forging, a single row of refractory fire brick, and a single adjustment device of the lever type. The double bungs which are removed for charging the furnace, consist of two of the ordinary single bungs bolted together at three places. The center bolt serves as a catch for the hook of a 1-ton chain hoist made by the Wright Mfg. Co., Lisbon, O., which traverses an I-beam suspended from the roof trusses. This arrangement is clearly shown in the illustration. The rectangular brick structure at the right serves as a bin for the coal which is used for fuel in the furnaces. The ashpan is shown in the foreground. The furnace is charged at about 7 o'clock in the morning and at 12:30, and pouring is commenced at about 11 o'clock in the morning and about 4:30 in the afternoon. The metal is tapped from each side of the furnace and is carried direct to the molds in small distributing ladles. The pour-back platform is shown at the left of Fig. 2. Skimming doors are provided on either side, as indicated in the above illustration.

FIG. 3—AMPLE CAPACITY FOR ANNEALING CASTINGS IS PROVIDED BY FOUR LARGE OVENS

Unusually serious difficulties were encountered in attempting to build the addition in the foundry to house the annealing ovens. It was found that steel could not be secured in less than six or seven months, and when local lumber dealers and contractors were approached on the subject of providing large timbers on short notice, they replied that it was necessary to order the lumber from Alabama and that it could not be secured in less than six months. Rather than be balked by these obstacles, the president of the newly-formed company, accompanied by a gang of 10 men went into the woods near Richmond and there they cut and shaped the timbers which were used as roof trusses for the new building. This expedient saved many months in the period required for constructing the new building, and was one of the factors which enabled the builders to complete construction work promptly. The heavy roof truss construction is clearly shown in Fig. 3, which is a view in the annealing room.

Routing of Castings

The core room, hard iron cleaning room, annealing ovens, soft iron cleaning room and shipping department are in a large room in the new building paralleling the molding floor. As shown in Fig. 7, which is a plan of the foundry, this arrangement provides for a steady movement of the castings in a straight line as they progress through the various stages of manufacture.

In the hard iron cleaning room, the castings are cleaned by a combination sand-blast and tumbling barrel made by the MacLeod Co., Cincinnati, and tum-

FIG. 4—VIEW IN THE CORE ROOM SHOWING ECONOMICALLY CONSTRUCTED RACKS AND CORE OVENS

bling barrels made by the W. W. Sly Mfg. Co., Cleveland. The dust from this equipment is collected in a MacLeod dust arrestor shown in Fig. 6. Castings which have been annealed are cleaned by the sand-blast barrels and tumblers all made by the W. W. Sly Mfg. Co., Cleveland.

The Annealing Ovens

The annealing ovens are of the type shown in Fig. 3. The four ovens are coal-fired from fire boxes at the rear. Hot gases from over the grates enter the annealing chamber at the top and circulate downwardly over the castings and are exhausted through adjustable vents near the floor. The doors are made in four sections, each of which consists of a double row of bricks securely packed in heavily braced channel iron frames. Pending the arrival of a crane which will operate on the I-beam shown in Fig. 3, it has only been possible to move the two smaller sections of the doors into place. This has necessitated building-up the additional opening with common brick and tearing this out after each heat. When the new crane is in place any one of the four sections of the door can be handled easily. The charging boxes containing the castings are handled by the charger shown in the illustration. As indicated in Fig. 7, the core room is in the northeast corner of the building. Coremakers' benches are situated along the east wall while the core oven and the core storage racks occupy the west section of the room. The core racks have proved of unusual value in handling the light cores used in the foundry. They consist of two standards of wood, drilled for 1-inch pipes which serve as racks for core trays.

The arrangement of the various departments of the foundry is ideal for the economical handling of material. As shown in Fig. 7, the raw materials consisting of coal, pig iron and scrap enter the foundry proper at the west. Here the materials charged into the furnace are placed on wood trucks, as shown in Fig. 5. It will be noted in this illustration that a few of the trucks are numbered on the side. These numbers, which in one case is 385 and in the other 392, refer to the number of pounds of a certain material which should be placed on the truck. The truck, with its approximate weight of charging material, is placed on a platform scale made by the Fairbanks Co., New York, and is then hauled to the furnaces for charging. It is expected that in a short time these trucks will be handled to and from the storage yard and the furnaces by an electric storage battery truck. The castings in the cleaning room are handled in the steel barrels shown in Fig. 6. These barrels are made by Ohio Mfg. Co., Painesville, O.

Sorting the castings after they have been cleaned in the annealed iron cleaning room, is a difficult problem because many of the pieces are of unusually small dimensions. A recent order filled in the foundry called for 50 tons of small chain links. As each of these links

FIG. 5—CHARGES FOR THE AIR FURNACES ARE CARRIED FROM THE STORAGE YARD TO TRUCKS

weighed 0.04 pound, there were 2,500,000 pieces in this single order. To facilitate the sorting of the castings, an inspection and sorting bench has been provided in the shipping room. The castings are taken from boxes on either of two sorting benches and are thrown into receiving boxes which are placed in a row between the benches. All out-going castings are weighed on floor scales made by the Howe Scale Co., New York.

Pay Molders' House Rent

The installation of equipment and machinery, although offering many difficulties, was accomplished in an unusually short time. The most serious stumbling block to the rapid formation of an efficient organization was the scarcity of labor. Long before the plant was ready for operation, it became necessary to scour the country for good molders. After considerable effort in this direction, it was found advisable to offer an inducement to molders who would become steady workers in the new plant. Accordingly, men were brought to Richmond from other labor centers with the understanding that houses would be provided for them and their families and that the rent would be paid by the company. This plan proved so successful in the earlier stages, that the company has adopted it in a general way. The fact that the company pays the rent is not allowed to have any bearing on the amount of wages paid the men. This policy, together with the knowledge that as soon as the man leaves the employ of the company his rent automatically stops, has been an important factor in building up a permanent and reliable labor organization.

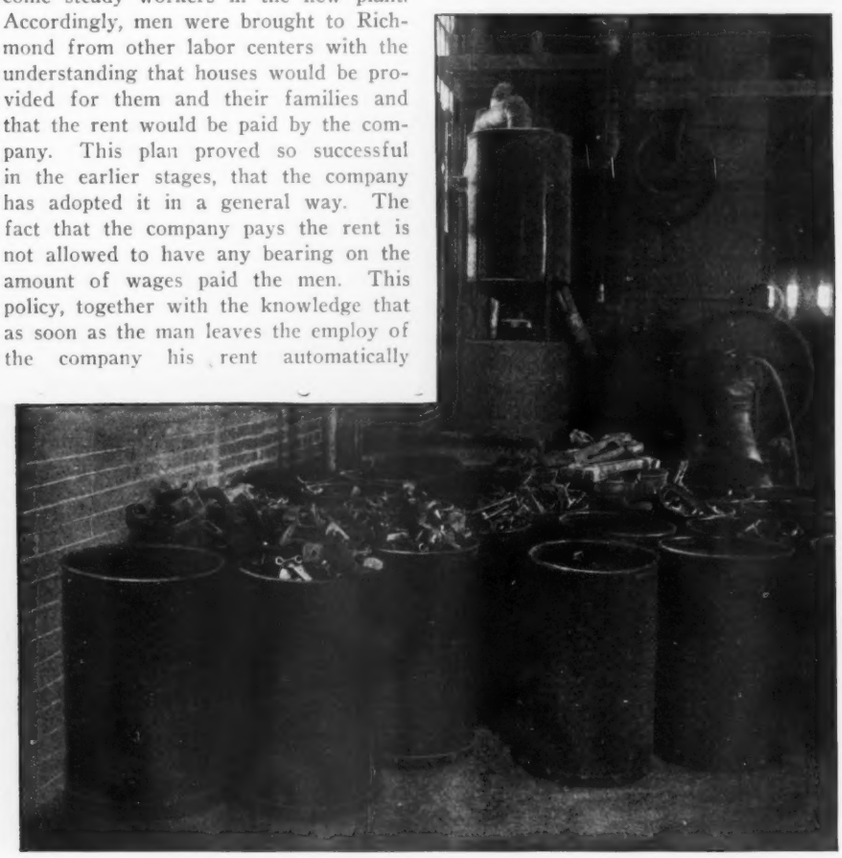


FIG. 6—CASTINGS ARE HANDLED IN THE CLEANING ROOM IN STEEL BINS

In addition to the inducement that is offered because of the rent-paying proposition and because of the unusually good working conditions obtaining in the foundry, the proprietors endeavor to make the wages attractive to workers. Molders who come to the Richmond shop for work and are accepted are put to work on a day-work basis. An accurate record is kept of the production of molds for each day, and as soon as a man acquires the skill and speed necessary to turn out a sufficient number of molds to make more money at piece work than he is already making at day work, he is placed on a piece-work basis. There is no tendency on the part of the owners of the foundry to interfere in any way with the amount of money a molder can make. It is felt that the extra production warrants the highest amount that a man can possibly make.

Despite the offer of good wages, it is almost impossible to secure experienced molders. For that reason, many of the men who are doing molders' work are novices. To counteract the inexperience of many of the workmen, the molding operations have been reduced to the simplest form. Most of the work is performed by means of match-plates and vibrators used in connection with snap flasks. No great amount of molding skill is required to operate these devices, and it has been found that inexperienced men can be trained in from six to eight weeks to turn out unusually good work with this equipment. Most of the castings made in this foundry consist of light and heavy hardware parts, wrenches, clamps, parts for hay-carriers, automobile castings and parts for lawnmowers.

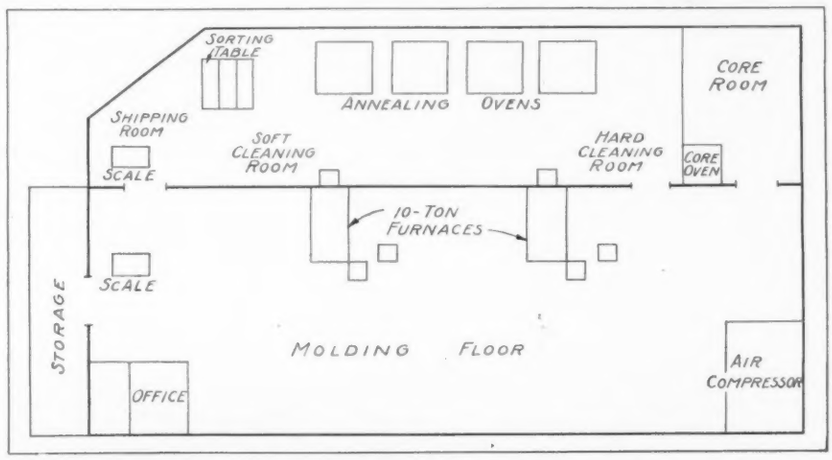


FIG. 7—PLAN VIEW OF THE RICHMOND MALLEABLE CASTING CO. FOUNDRY

Pours First Iron in 90 Days

In spite of the difficulties encountered in perfecting this organization and installing the equipment the plant, which was acquired Nov. 1, 1916, was ready for operation Jan. 31, this year, and on this day the first heat was successfully poured. This performance, which in reality means that a complete malleable foundry was put in operation in 90 days, was due principally to determination of the men interested to avoid and overcome the obstacles imposed by present day deliveries of material.

The details of the organization were worked out by W. J. Blackmore, secretary and general manager, and C. D. Calvelade, superintendent. J. M. Lontz, president, and H. R. Lontz, vice president and treasurer, were also responsible for overcoming many of the difficulties encountered.

The Detroit agency of the Whiting Foundry Equipment Co., Harvey, Ill., is now in charge of R. E. Prussing, 318 Penobscot building. Mr. Prussing has been connected with the Whiting Foundry Equipment Co. for the past 10 years.

Employment of Female Labor in the Foundry

Only by Elevating Coremaking to an Attractive Occupation Can Foundrymen Hope to Hold the Services of Efficient Women Workers

By W L Churchill

THE present and growing shortage of male help brings up the problem of substituting female labor therefor. Casting plants are especially hard hit as the nature of most foundry occupations is such as to employ only vigorous, robust men, many of whom are being drafted and the more attractive employment of other lines is tempting others away.

In the molding department of the foundry there is little opportunity for the utilization of female help with present facilities and arrangements. However, for making small cores, women have come to stay as the work is especially adapted to female labor. Many foundries already have arranged their small coremaking on a basis to utilize female help, but only a small number have done it in a manner to make it an attractive occupation for the average type of woman worker.

There is nothing inherent in the work of making small cores that is disagreeable, unsanitary, or unduly laborious for women. If cores were food products and made in "Sunshine Biscuit" bakeries where all the smoke and dust are kept out of the department where women are employed and where they are provided with every comfort and convenience to make their work attractive, coremaking would have as many and as desirable types of applicants as the more modern fancy biscuit and confectionary plants.

It is possible to make the occupation of coremaking an attractive one to a good class of women and the foundry that elevates this occupation to such a basis reaps a harvest of reduced costs, lessened spoilage, accurate work and an increased volume of output. It is not a difficult problem to arrange a core room satisfactorily, as it involves only the selection of a proper location permitting the making of small cores where the smoke, dust, noise and generally disagreeable atmosphere of the average foundry can be eliminated.

Such a place usually is found for patternmaking, but the coremakers too frequently are compelled to work in an atmosphere of stifling smoke and gases, with surroundings of dirt and caked grime that can only induce low human standards to tolerate.

Simply partitioning off a corner of a smoky, dirty foundry or coremaking department is far from solving the problems properly, although many foundries get away with such makeshifts and do fairly well with women coremakers employed in such parodies of desirable work rooms. All too often these rooms become a hanging out place for an element of the male labor about the foundry, which destroys all discipline and makes for indifferent and low output.

Simply replacing male coremakers will not get the results that are possible, as the whole subject needs to be studied with an understanding of how best to utilize women workers.

First, they must have an absolutely wholesome atmosphere to work in. This is impossible when cores are baked in the same room in which they are made.

Good Working Conditions Essential

Second, the women coremakers must be separated from the male workers and should be assisted and instructed by as few men as possible and these should be of a type selected for their general desirability and understanding of the class of people they are serving.

Properly arranged, a coremaking department should have such privacy for its women employes that they do not meet the other employes except the few that help and instruct them.

They should have separate, private entrances and should begin work after the other foundry departments and should leave at an earlier hour.

An ideal solution of this problem was effected by the writer in 1913. This has stood the test of time and illustrates the possibilities of properly directed effort.

The foundry in which this department was installed, constantly was short of molders and had introduced female coremakers to some extent, thereby liberating a few men from the core department to be utilized as molders. No attempt was made to change the coreroom conditions in any way; the foundry superintendent had merely obtained such women as he could attract with good wages to work in the smoky, noisy, filthy, department, and other than threatening with discharge anyone caught annoying these women, little was done to make their occupation desirable or safe. They were obliged to get the sand mixtures, core wires, plates, etc.; they carried the cores to the ovens, even in some instances doing the baking.

The plant had a one-story warehouse for the storage of surplus castings and as the policy of making surpluses was discontinued, the building was available for other purposes. The warehouse had a cement floor and plenty of windows. It was equipped with a heating plant, painted white, and was fitted up with a generous cloak and wash room. A combined rest and lunch room was provided and a type of coremaking bench was designed that permitted the coremakers to work while seated on comfortable, backed stools.

The benches were so placed that the women coremakers did not have to leave their benches or stools. The finished cores were placed by them on take-off tables from which they were removed by core-carriers who delivered them on rubber-tired spring buggies to the corebaking room which not only was separated from the coremaking room, but was so thoroughly ventilated that little if any smoke or odor from the ovens reached the coremakers.

The coremaking tables had slide chutes projecting over the service aisles into which the core sand was supplied from tote pans by the man employed to supply such mixtures. The men also distributed plates, core wires and other supplies as needed, and as the room was kept scrupulously clean and the girls supplied with caps and uniform overall aprons, it resembled a business college more than a typical coremaking department.

Separated by the cloak room from the rest of the coremaking department, the tubs and jolt machines for the heavier cores made by male coremakers were placed next to the corebaking and sand-mixing department. This brought the biggest sand users nearest to the sand supply and ovens and also effected a separation of the

women coremakers that enabled them to conduct their work in such privacy that brought them in contact with only a foreman and two young men who supplied sand and took away the finished work. A private entrance led direct to the street, and with a time clock for their sole use and by having them report for work later and dismissed earlier than the other foundry employes, their privacy was complete.

When first instituted, the 10 or a dozen women already employed in the former core room were transferred and were requested to help get more girls to fill up the new core tables. Naturally they brought other women of their acquaintance, chiefly non-English speaking foreigners and much to the surprise of the management an indignation meeting was held by the girls employed in the packing department connected with the plant and a protest was submitted calling attention to the evident partiality being shown to foreigners in giving them better work, in better surroundings, and better conditions than the natives enjoyed in the other manufacturing branches.

Cost of Cores Lowered

As a result of this careful arrangement a desirable type of women workers sought positions in the coremaking department, and although piece work was temporarily abolished, the core costs made an immediate and substantial drop, quality was greatly improved, production was accelerated and increased and a number of men workers were obtained for other foundry occupations.

The type of tables designed especially for the women, which provided means of supplying sand and other materials without interruption of work, was a large factor in the success of female labor in this foundry. Placing the department where there was no occasion for other employes to enter it and where the general foundry atmosphere was entirely absent, removed all objection to employment in such a department by anyone suited to this class of work.

There are few foundries making small, cored castings in large quantities, that cannot profitably undertake to put this work on a basis to be done by women, and the more attractive they make it the greater will be their reward. Also, it is not without influence in elevating the tone of the entire establishment, even with a complete separation of the department from contact with the other employes during business hours. The fact that women acquaintances find desirable occupations in a foundry is apt to make a young man who is considering a trade to look into the possibilities of the foundry when otherwise he would not give it a thought.

How the Sales Engineer Views the Foundry

By H R Atwater

MUCH has been written in reference to the lack of business methods in the foundry industry as a whole, and to the lack of appreciation of the importance of adopting progressive modern methods and labor-saving devices. Undoubtedly this criticism has been well merited, but it is also true that much has been done toward bringing the foundry up to a productive point comparing favorably with other lines of manufacture.

It would not be an exaggeration to say that for the past five years the method of producing castings has been revolutionized. The number of pieces produced in plants per man unit has been increased in some instances 500 to 1000 per cent. This has been due principally to the installation of molding machines, means for bringing iron to the floors, sand handling devices and equipment for handling the molds from the machines.

Never before in the history of the foundry industry have the demands for greater output been so insistent as at this time. Labor is constantly demanding a larger share of the profits of the industry, and I am sure that every right-minded man wants to see the rewards of labor increased. However, labor rewards cannot be increased by simply forcing up prices on one another, in order to get this increased wage. If the increase is to be permanent and such as can be met by the manufacturer, the production must be speeded up—where we are now getting one mold we must get at least three from no greater increase in the labor unit. To do this means better equipment and more knowledge of its use and possibilities. Those foundries that are operating entirely under old hand methods are being called upon to pay a higher wage than can possibly be afforded, and in many plants the hand molder is almost an impossibility when comparing the wages demanded to the production he is willing to turn out. This condition has forced many foundrymen to install not only molding machine equipment, but methods for handling iron in pouring off the work, and in fact any equipment that will save labor and reduce the number of men required.

Opposition to Molding Machines

It is generally stated as a fact that molders do not take kindly to molding machines, or in fact to the use of any other modern device that may be placed in the foundry. In many plants this has been demonstrated to be true, although the writer knows of plants where union molders in good standing work on molding machines and turn out a production in some cases 1000 per cent greater than was done when the work was made by hand. Moreover, the wage earned is more than double any union scale in force in any foundry in the country. In stating this fact it is not intended to open up a discussion as to which is the better method—that of trying to work molders on machines or breaking in laborers to operate them—but rather to bring up the question before the foundry industry and to ask if it is looking far enough ahead with sufficient vision to meet the requirements. Is it taking the opportunity to organize the plants and to equip them so that their production will not be cut down? This is the important thing whether operating with molders or so-called handy men. In these days when men are so scarce and the need of increased production is great proper means must be found to work both molders and handy men to their capacity.

It is the writer's opinion that the success or failure of modern equipment and particularly molding machines in any given plant depends on the state of mind. Unless complete co-operation is given from the head of the plant down through the superintendent, foreman, patternmaker or others in charge, no very considerable success will be obtained from either the working of molders on the machines or the use of laborers. The thought and co-operation necessary to make a success must be such as to make a careful analysis of the cost of production on given patterns, an understanding of the proper rigging of the patterns and the kind of flasks to be used, and the price basis established on a quantity production that will largely increase the wage of

This paper was presented at the Boston meeting of the American Foundrymen's Association. The author, H. R. Atwater, is sales engineer, Osborn Mfg. Co., Cleveland.

FORMULAS FOR THE BRASS FOUNDRYMAN

NAMES AND COMPOSITION OF MISCELLANEOUS ALLOYS

Damar Bronze

This alloy is used as a bearing metal, the composition being approximately as follows:

	Per Cent
Copper	76.50
Tin	11.00
Lead	12.50

Graney Bronze

This alloy also is used for making bearings. Its composition follows:

	Per Cent
Copper	75.50
Tin	9.50
Lead	15.00

Die-Casting Alloys (Bronze)

ANALYSIS NO. 1

	Per Cent
Copper	79.26
Zinc	15.24
Aluminum	4.78
Manganese	0.16
Iron	0.56
Tin	Trace

ANALYSIS NO. 2

	Per Cent
Copper	79.42
Zinc	16.00
Aluminum	3.85
Manganese	0.13
Iron	0.60

ANALYSIS NO. 3

	Per Cent
Copper	89.88
Aluminum	10.06
Manganese	0.06

FORMULAS FOR THE BRASS FOUNDRYMAN

NAMES AND COMPOSITION OF MISCELLANEOUS ALLOYS

Electrode Bronze

	Per Cent
Copper	87.39
Tin	7.25
Manganese	0.18
Zinc	4.95

This bronze was used as the material of construction of bronze, water-cooled electrode holders for ferro silicon furnaces. It is a good tough metal, suitable for many purposes where such an alloy is specified. The manganese content is somewhat higher than necessary. This should be represented by the addition of 0.5 per cent of 30 per cent manganese copper as the maximum.

Kochlin's Bearing Alloy

	Per Cent
Copper	90
Tin	10

This alloy is usually deoxidized with phosphorus, using 0.25 per cent of phosphor copper.

Lafond's Heavy Friction Metal

	Per Cent
Copper	83.00
Tin	15.00
Lead	0.50
Zinc	1.50

Harrington Bronze

	Per Cent
Copper	57.00
Zinc	41.00
Tin	1.00
Iron	0.75
Aluminum	0.25

This alloy somewhat resembles manganese bronze, but is deficient in elongation. It may be used for unimportant castings where cheap metal is specified.

THE FOUNDRY DATA SHEET, DECEMBER, 1917

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

Note—This sheet may be cut into two sections, 5 x 7 inches, and may be readily bound in note-book form.

the operator as well as bring a largely increased production to the plant. It is not possible to get a largely increased production unless the operators are to share in this increase.

I have come in contact with owners of plants where a few machines have been installed, whose sole concern seemed to be how much they could cut the molding price on all patterns that they put on machines, and the idea uppermost appeared to be that the price of the equipment should be returned to them in the first few weeks or months of operation. Naturally no large production is ever obtained in plants where this policy is pursued. Unless the men in immediate charge of foundry production first make a careful study of the possibilities of the equipment which has been installed as to the amount of work it is capable of turning out and establishes a production that is somewhere near the capacity of the equipment, they are not in position to fix a price or a wage that will insure the machines being operated at their capacity. If the equipment installed is capable of earning 100 per cent on the investment, the responsibility of realizing this must be shared in a liberal way with the men who are asked to operate

A Word to the Foundry Foreman

It would seem at this point that a word regarding the foundry foreman would be worth considering. We cannot hold a man responsible for what he does not know and it is a certainty that most of the failures to get satisfactory production from machine equipment, come from ignorance both as to the possibilities of the equipment, the amount of production that should be obtained and the wages that should be paid to get the production. There are foundries now operating in which this matter has been investigated so thoroughly and with such a broad vision that the matter of production and wages is causing them no trouble. It is not probable that these problems will bother the owners of these foundries greatly in the future, for they have builded well and they will keep well to the front, whatever demands may be made upon them. They will be in a position to properly meet all the varying changes, as they come up.

It would seem that the foundry industry as a whole could make no better investment than at every opportunity to have their foundry foremen, superintendents and those in immediate charge of production, visit modern plants, study equipment on exhibition at the different foundry shows, and encourage them to think along lines of conducting the foundries on business principles. The foregoing remarks cannot be applied to all foundries, owing to conditions that exist as to buildings, room for installing equipment, etc., which will not permit of operating modern equipment to the maximum production, but it is the writer's belief that if plants now operating under these handicaps are to continue in the production of castings and to meet competition, these conditions will have to be changed.

In these days it is the labor unit that must be considered, and it usually follows that men will go where the most modern equipment is furnished and where they are required to perform the least amount of labor at the highest wages. It is the writer's observation that power-operated machines are the ones most favored. Hand-operated machines are not far enough removed from hard labor and the so-called skill of the molder to insure the best results. As the hand molders cannot compete with machine production even when operated by hand, neither can the hand-operated machine compare favorably with the power machine in production or saving in hard labor. It naturally follows that the hope of the foundry in the future must be in installing power equipment and in teaching laborers to successfully operate machines that will produce the largest possible output and net the operator more money than he can possibly earn at any other work. Devices also must be furnished him that will make the labor less hard than it has been. Only in this way can the industry hold its men and turn out an equitable production.

A Troublesome Gating Problem

By R R Clarke

THE trouble was like Banquo's ghost, it would not down. It came about because a surface-attaching gate deposited its metal directly against and over a thin and necessarily weak green sand projection, in and running entirely around the central part of the mold. It was a ring projection of green sand in the mold and practically impossible to miss by the surface gate. We had as possibilities either the dry sand core projection or the horn gate. We chose the horn gate. The patterns were plate mounted for snap flask molding on a pneumatic squeezer machine, three patterns exhausting the intaking capacity of the flask. These patterns made blank gear wheel castings in which accuracy was high. The first time we saw the castings made, over 75 per cent of them were lost from sand-washing. Before discarding the surface gate, we tried practically every trick of the trade in order to retain it. Forced to the departure we placed core prints on the pattern, the prints accounting for horn gates in the green sand back of the core. By this method, we delivered the metal to the bottom of the mold and calculated that it would rise placidly over this ring projection and do no harm. In this we were sadly mistaken as the trial mold readily demonstrated. The trouble was that the metal was dammed up in the central portion of the mold and exerted a pressure beyond the resisting power of the sand projection to withstand. This sand consequently gave way before the metal had a chance to overflow into the outer circle.

We kicked the trial castings into a corner where no one would see them and resolved to do something. We remembered that in the nostrils of all correctly put together humans is a little tube leading back to the inner chambers of the hearing mechanism. Hold your nostrils tight, blow hard and you will discover this little tube a part of your own anatomy. Its object is to admit air into the inner cavity in order to protect the delicate tympanum or eardrum against the strong atmospheric pressure from the outside; in short, to equalize that pressure. We decided to imitate, first concluding to part the green sand projection just enough to allow the metal to flow through it and into the outside simultaneously with the inside. But this would make a hard chipping job so we sought another remedy by which all metal channels would locate on the outside casting surface. To realize this objective we bored a ¼-inch hole in the gate core in line with the gate of the gate core and at that point in the casting where the metal would enter the outside ring simultaneously with its rising to the lower edge of the green sand projection on the inside. Our reasonings were that the metal would flow down the horn gate past the hole in the core and rise to the same level in the gate and casting until this core opening was reached when it would flow into the outside ring through this opening and back the green sand projection against the inside metal pressure. Results amply substantiated the argument and we are realizing the very best of castings.

We made the evil self-correcting and fool-proof with no perceptible exaction on the machine molder's time. This we consider one of the first line principles of successful machine molding.

How to Solve a Foundry Lighting Problem

By Following a Number of the Fundamental Principles of Illumination, a Practical Foundryman Can Plan an Efficient Lighting System

By C E Clewell

TO ILLUSTRATE some of the practical phases of foundry lighting, it is the purpose of this article to describe briefly, the methods employed in planning the lighting in a large foundry in northwestern Pennsylvania where, after a number of tests, it was found desirable to install flaming-carbon arc lamps according to a design worked out by the writer. This particular case is not selected on account of the type of lamp used but to explain the principles involved. It will be noted throughout the article that the methods of calculation apply equally well to other possible types of lamps such as the tungsten, mazda and the mercury vapor lamps.

Fig. 2 shows in plan and elevation the general arrangement of the foundry in question. Like many other industrial plants, this building has a low overhead clearance, making it necessary to mount the lamps not much more than 18 feet above the floor. To anyone attempting for the first time to plan out such an arrangement of lamps for producing a satisfactory lighting effect, the difficulty of telling just how many lamps to use will come up as one of the first questions to settle.

It is almost as important, however, to determine whether the direction in which the light is given off by the lamps is such that most of the illumination will reach the mold surfaces. It is not enough that the horizontal surfaces shall be sufficiently lighted, since it is also necessary to light perpendicular surfaces. It is, therefore, frequently necessary to determine whether a sufficiently large side component of illumination on the working surfaces is going to result from lamps mounted overhead, as shown in Fig. 2.

Why Certain Lamps are Selected

We will consider that a floor plan like that in Fig. 1 is to be lighted by lamps of a certain type mounted overhead. For example, the management of the foundry may have selected a certain type of lamp because of its apparent ability to penetrate through the smoke and dust so often present in the air, or for some other cause not directly connected with the way in which the light is distributed about the lamp. Assuming that a flaming-carbon arc lamp has been selected for some such reason, let us proceed to check up this type of lamp as applied to the conditions of floor area and ceiling height in Fig. 2.

From the lamp manufacturer we can usually find how the light is distributed about the type of lamp chosen, as illustrated in Fig. 1. This diagram simply means that by actual measurement the lamp sends out about 1,075 candle-power in a vertically downward direction; about 1,320 candle-power at 10 degrees to the vertical, and so on. The use of this curve will be explained later. If the designer of the installation has data available on other installations of the same type of lamp, he may have at hand a figure telling hom how many watts (units of electrical energy) per square foot of floor area the lamps consume as usually employed for foundry work. If such a figure is at hand, he then need only multiply the total floor area by the watts per square foot usually employed, to obtain the total watts required by all of the lamps, and this figure then divided by the watts consumed per lamp, gives the number of lamps necessary to light the foundry to an intensity of illumination approxi-

The author of this article is assistant professor of electrical engineering, University of Pennsylvania, Philadelphia, and author of "Factory Lighting," published by the McGraw-Hill Book Co.

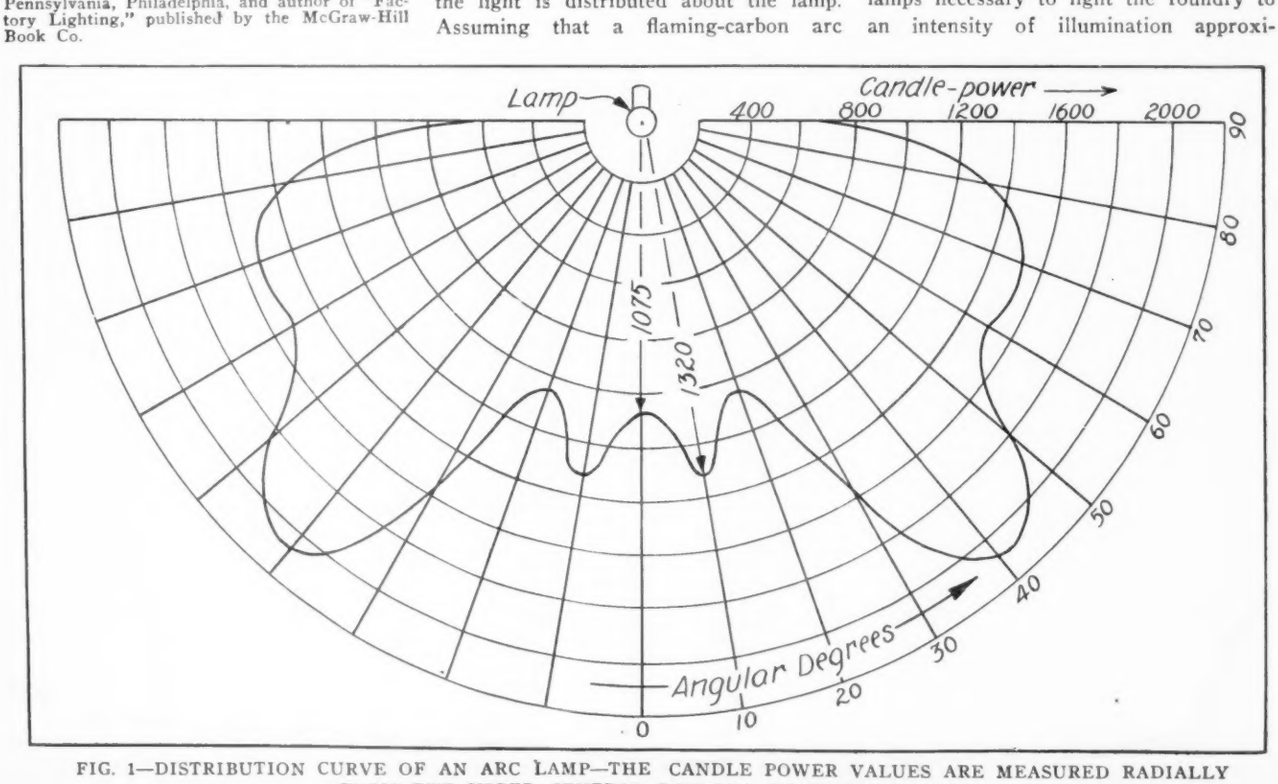


FIG. 1—DISTRIBUTION CURVE OF AN ARC LAMP—THE CANDLE POWER VALUES ARE MEASURED RADIALLY FROM THE UPPER CENTRAL PORTION OF THE DIAGRAM

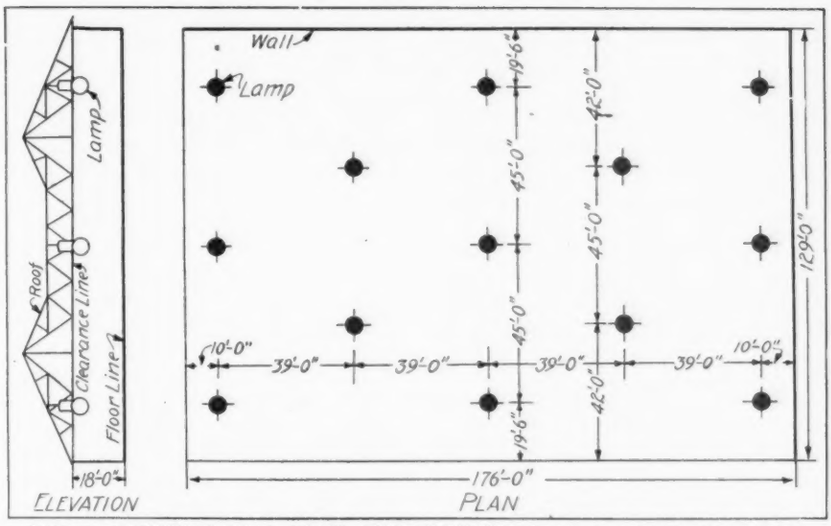


FIG. 2—CONVENTIONAL PLAN AND ELEVATION OF A LARGE FOUNDRY SHOWING ONE WAY IN WHICH TO ARRANGE 13 LARGE ARC LAMPS OVERHEAD

mately equal to that of the previous installaton. Thus we may write the following simple relation:

$$N = \frac{W A}{W}$$

where N stands for the number of lamps required; w for the watts per square foot necessary to light the work based on other similar cases; A for the floor area in square feet; and W for the watts consumed per lamp of the type chosen. Great care must be exercised in handling this calculation to make sure that the "watts per square foot" value used corresponds with the type of lamp to be used. Thus, if tungsten or mazda lamps are to be used instead of arc lamps, A watts per square foot value suitable for mercury vapor lamps or for arc lamps cannot necessarily be employed for the mazda lamps, and the reverse is also true.

Locate Lamps Symmetrically

In the foregoing case, after determining the number of lamps necessary for an overhead arrangement it usually is best to locate these lamps on a drawing in a symmetrical manner over the ceiling area somewhat as indicated in Fig. 2. It will often be found desirable to check such an arrangement by means of the distribution curve of the proposed lamp, first, to determine whether the illumination on the work is uniform and secondly, to find whether it is sufficient in quantity.

This check may be made by means of the relations shown in Fig. 3. Thus, if the illumination intensity at a point directly below a lamp is to be found, look at the distribution curve, Fig. 1, and observe the value of the light in candle-power given off vertically downward. This, divided by the square of the distance between the lamp and the working surface, gives us the intensity (in foot-candles) at this point due to this one lamp. The foot-candle is used here as the unit of illumination intensity. Thus, the illumination intensity on a surface produced by a one candle-power lamp located at a distance of one foot from the surface, is equal to one foot-candle. At two feet from the surface, the lamp will produce one fourth of a foot-candle, and so on. In other words, the intensity varies closely as the inverse square of the distance between the surface and the lamp.

We must now determine how much intensity is contributed to this same point by all the other lamps, by duplicating this calculation for each lamp which is near enough to the point to contribute any light to it. For all the other lamps, except the one directly above the point on the floor in question, it is necessary to multiply the quotient of candle-power and the square of the distance between the lamp and the point *by the cosine of the angle between the line joining the lamp and the point and the vertical line,* so as to give the vertically downward component of the illumination at the point under consideration.

This is made clear by reference to Fig. 3, in which the vertically downward intensity at any point other than the point directly below a lamp, is found by the equation:

$$\text{Intensity} = \frac{\text{c. p.} \times \cos (b)}{d^2}$$

It will be noted that the value of d is different for every point chosen. Hence a more convenient form in which to use this relation is the following modified form:

$$\text{Intensity} = \frac{\text{c. p.} \times \cos^3 (b)}{h^2}$$

In this equation, c. p. stands for the candle-power, b for the angle, and h for the mounting height of the lamp above the working plane. Note that h has the same value for any point that may be taken on the working plane, so that it is more convenient to use h than d in spite of the fact that by so doing the third power of the cosine must be introduced.

Refer to State Codes

To check uniformity and intensity of the illumination at representative points over the floor area, it is necessary to duplicate the rather long set of calculations just outlined for a number of points over the working plane. After carrying out this work, the results indicate whether the vertically downward illumination is uniform and also its value, and the latter should then be checked against the intensity called for by the state industrial lighting code for foundry work, or if no such code is in

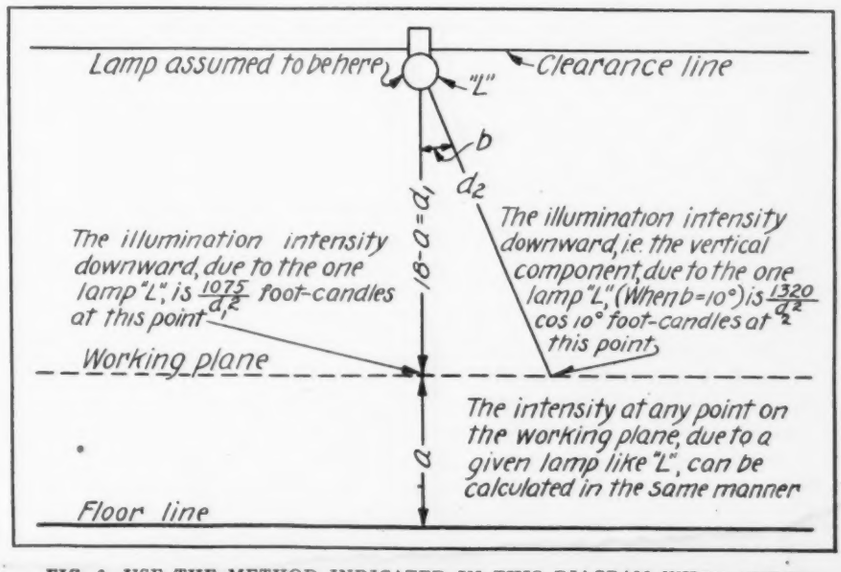

Lamp assumed to be here
"L"
Clearance line
b
d2
18'-0" = d1
The illumination intensity downward, due to the one lamp "L", is 1075/d1² foot-candles at this point
The illumination intensity downward, i.e. the vertical component, due to the one lamp "L" (When b=10°) is 1320/d2² cos 10° foot-candles at this point
Working plane
The intensity at any point on the working plane, due to a given lamp like "L", can be calculated in the same manner
d
Floor line

FIG. 3—USE THE METHOD INDICATED IN THIS DIAGRAM WHEN CHECKING FOR UNIFORMITY AND INTENSITY—THIS DIAGRAM IS TO BE USED IN CONJUNCTION WITH FIG. 1

force, against some authority. To illustrate, the factory lighting codes in the states of Pennsylvania and New Jersey call for a minimum of 1.25 foot-candles for foundry work, and recommend as desirable from 1.25 to 2.50 foot-candles for such work. The illumination on vertical surfaces can be checked up in like manner *by using the sine* instead of the cosine of the angle shown in Fig. 3.

Enough has probably been indicated to show that these calculations require considerable care and dexterity, and many cases are likely to be of sufficient importance to call for expert service in advance of making the installation. Furthermore, it is always possible to check up such an installation of lamps after its completion by actual measurements, in order to ascertain whether or not the results based on the calculations have turned out as expected, or whether some slight change is required to make the system meet all the requirements.

If the designer of the system has no figures available at the outset giving the watts per square foot of floor area for suitable lighting, he may be forced to locate the lamps on a drawing of the floor area in a symmetrical manner., the number of lamps chosen being determined purely by guess-work at the start. The check on uniformity and intensity previously described should then be carried out and if the quantity of illumination on the working plane is too low, the lamps should be rearranged on the drawing and a new check made. This cut-and-try method should be continued until the intensity and uniformity of illumination conform to standard practice.

Practices of the Designer

Of course, a laborious cut-and-try method to this extent would hardly be necessary after a designer has gone through several typical experiences, for when a new location comes up, he can refer back to the calculations covering a somewhat similar case with which he has had experience, and probably soon arrive at a close figure for the number of lamps to select. This discussion shows one reason why a lighting expert is usually in a better position to tell how a system should be laid out than a man who attacks such a case for the first time.

The foregoing suggestions will give the practical foundryman an idea of a few of the points involved in planning a lighting system. There are many other points which have a bearing on the problem, but it is perhaps best in a brief article like this to discuss the problem from one angle only, since the introduction of too many factors might tend to confusion.

It is hoped, however, that this brief recital of some of the factors involved in foundry lighting, may not only prove of interest, but may tend to make those who use light in their work, more careful of the way they subject their eyes to unshaded bright lamps and other similar harmful effects. In other words, this article, in addition to its practical suggestions, has endeavored to emphasize the importance of giving special care to the lighting problem, which frequently does not receive the degree of attention its importance warrants.

Labor Appreciates the Human Element

By J F Kent

WHETHER his skin is white, black, red or yellow, man is a social animal. You can work a mule from one year's end to another and as long as you keep his stomach full he is satisfied. A man is different. On Saturday night he looks for something besides a pay envelope. You can't treat him as an animal or a machine and successfully get away with it for any length of time. He is a man and you are a man, and in that kinship lies the secret of good or bad relations.

Recognition of that kinship goes by many names, the most popular probably being "Welfare Work". No matter what you call it, however, it is the same thing; it exists in any business where men work for other men, and in any state or country. In the foundry of the American Cast Iron Pipe Co., Birmingham, Ala., we have endeavored to give this relationship proper recognition. When I first went to Alabama, a good many years ago, I heard men with experience say that negro labor was not dependable, and that the "only way to handle a negro was to take a pick handle or some similar persuasive implement and knock him in the head about twice a week". Today three-fourths of the laborers in our shop are negroes. They are as dependable as any ordinary class of labor, and in making them so the pick handle method never has been used.

Encouraging Habits of Cleanliness

At no kind of work will a man get as dirty, perhaps, as in a big pipe foundry. Therefore, one of our first steps was the construction of a brick bath-house large enough to accommodate all of the employes. In the 12 months from Oct. 1, 1915, to Sept. 30, 1916, white employes took 25,753 baths and negro employes 166,477. When our men go to and from work they are dressed in good clothes, with white collars and polished shoes. Few would imagine that they worked in a pipe foundry. The indirect value of these baths upon the negroes is beyond estimation. As anyone might surmise, whose olfactory nerves ever came within business distance of a thoroughbred southern negro on a warm day in June, the race is not particularly addicted to the bathing habit. The baths our men get at the shop, therefore, not only keep them clean, but communicate the infection to their families and friends, with the result that the waterworks company has a growing consumption as far as the negroes are concerned. We installed a medical department, which, from a small beginning, has developed until today we have a thoroughly equipped operating room, consultation room for both races, dental parlors for both races and a drug dispensary. This establishment is conducted by two doctors; one a high class surgeon and general practitioner, and the other a physician; a white trained nurse; two negro trained nurses; a dentist, and a consulting board composed of several of the leading specialists of our city. Employes pay for this service at the rate of 50 cents a month for single men and $1 a month for married men For the married men, all members of his family are entitled to the services of the department. Needless to say, this work is very far from self-supporting. Our motive in assessing the dues being to impress upon the employe some degree of its importance and prevent abuse of the system.

Every new man now employed must stand a thorough physical examination, and if the doctors find any condition present which might endanger the health or safety of other employes the applicant is refused employment. Injured men are given first-aid treatment at the dispensary, and when seriously injured are taken to one of the city hospitals. Some years ago we had one or two cases of tubercu-

A paper presented at the Boston meeting of the American Foundrymen's Association. The author, J. F. Kent, is general manager of the American Cast Iron Pipe Co., Birmingham, Alabama.

losis, and we constructed out-door houses for the afflicted men on top of a mountain near the plant, where their recovery has been complete.

We have constructed a 3-story Young Men's Christian Association building. In charge of the association's activities are two trained secretaries, one who remains at the plant and one who spends his time visiting the homes of the employes, where he advises them about many of the phases of their daily life, especially regarding thrift, sanitation, disease prevention, cookery, education, religion and similar subjects. This work, of course, is confined to the negroes.

A mutual benefit association is in operation which has a thousand members out of a possible 1200, and which pays out monthly in sick, death and accident benefits an average of about $500. A few stastistics afford a quick way of covering the ground. They include a period of 12 months as follows:

	White	Negro
Men's bible classes	600	1,733
Boys' bible classes	564	.....
Sunday school	3,754	547
Socials for men only	545	1,315
Moving picture shows	4,564	16,030
Educational classes	1,035	3,537
Library books used	839	40
Shower baths	25,753	166,477
Number served at restaurant (mixed)	201,604	
Number served in dining room	7,154	
Amount deposited in savings bank	$1,514.71	
Taught to read and write	13	
Attendance at athletic games, players	3,953	
Attendance at athletic games, spectators	12,030	
Medical, surgical and special cases treated at medical dispensary	21,697	

There are a few other phases of this welfare work which I might mention incidentally, such as a week's vacation given the shop last summer on full pay; a suggestion box plan by which every employe is given an opportunity to make suggestions for the more economical or safe operation of the plant and for which cash prizes are awarded; a cash bonus of from 5 to 10 per cent on each employe's salary for the year 1916 as high or higher wages as are paid by any other employer of labor in the district; financing of homes for white employes and the construction of a model negro village with nice homes for rental to the negro employes; active and aggressive safety work in every department.

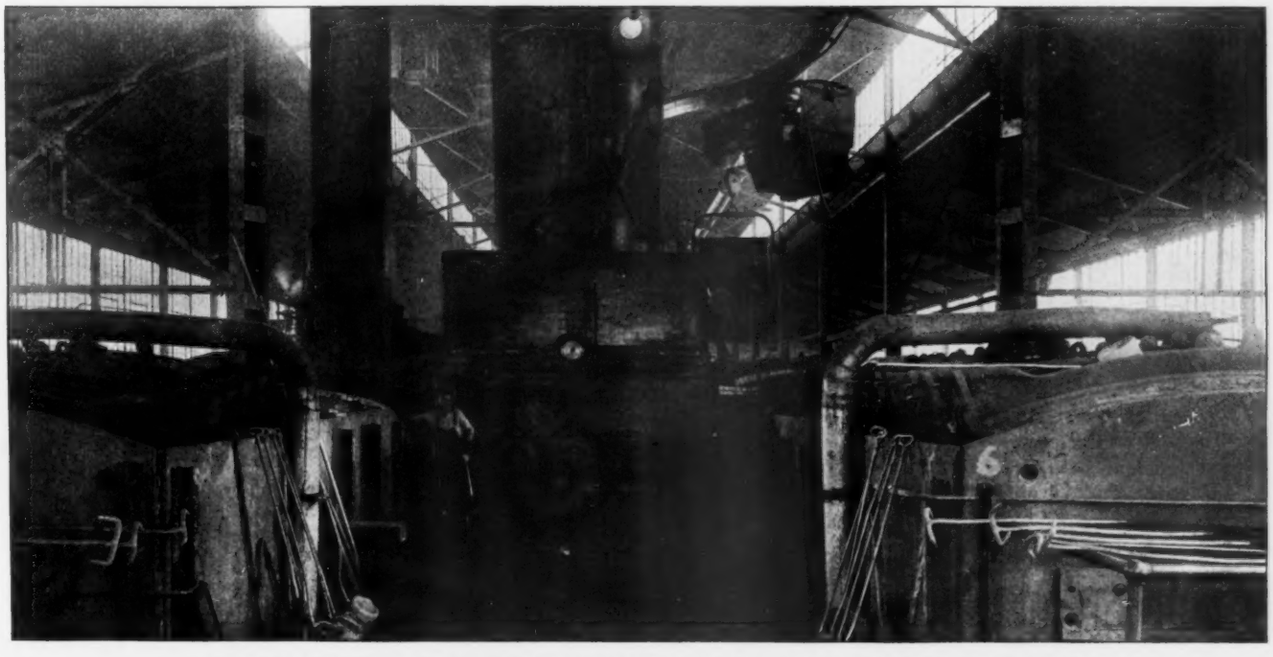
While this, of necessity, is little more than a mere catalog of what we are trying to do, I believe it should give you a more or less vivid picture of what we are using instead of the pick handle. We believe, and endeavor to make our employes realize, that their success is dependent upon ours, and ours upon theirs. As the chairman of our board of directors puts it, we strive to see "how much, not how little, wages we can pay; how easy, not how difficult, we can make our work".

Boilers Reclaim Melting Furnace Heat

By C D Townsend

AFTER considerable investigation of the various kinds of boilers, including horizontal, marine, and others, an upright water-tube boiler finally was selected as the equipment best suited for the utilization of waste heat from melting furnaces. The fact that the floor space required was comparatively small was an important factor in determining the choice. The next question was size, and the results of deliberations with the engineers were that it was preferable to have the boiler over-size rather than under-size. A 250-horsepower boiler was estimated to be of sufficient size, considering the grate area of the furnace; but because of what might be called a superheated gas after it has passed over a bath of molten metal, and because of its velocity, greater capacity was deemed advisable and a 400-horsepower boiler was finally decided upon as being adequate for any emergency. In order to utilize the waste gases from the furnace and get constant results from the boiler, and also to keep the boiler under steam pressure all the time, it is best to have two furnaces and an auxiliary fire-box connected with the boiler. By running the furnaces one at a time during the day, a full head of steam can be kept on the boiler, except for intervals during the time of charging the furnaces, and for

The author of this paper, which was presented at the Boston meeting of the American Foundrymen's association, is general manager, Danville Malleable Iron Co., Danville, Illinois.



WASTE-HEAT BOILER SHOWING AUXILIARY FIRE BOX AND MELTING FURNACES

a short period while the cold stock is being thoroughly heated. This takes care of all firing necessary on the boiler for at least 9 hours of the day. During the balance of the day the boiler can be kept under pressure with a slight amount of fire through the auxiliary fire-box. One furnace is operated while the other is being repaired; and then the order is reversed.

Regulate Temperature by Draft Fan

The temperature control in the furnace and the efficiency of the boiler can be very materially aided by the addition of an induced-draft fan in the base of the stack. By operating this fan with a variable-speed motor or steam engine, the furnace draft can be regulated as desired. The use of the fan tends to hasten the time of melting and, due to the velocity with which the gases are drawn through the boiler, the efficiency is increased. The temperature in the base of this stack is approximately 800 degrees Fahr., and the temperature at the back bridge-wall of the furnace is about 2500 degrees Fahr. These figures show that a large volume of waste gas is used in making steam. With this equipment approximately 246,000 pounds of water are evaporated per day. In the auxiliary fire-box, from one to three tons of coal per day are used, according to requirements.

As before stated, connecting two 20-ton furnaces to the auxiliary fire-box of the boiler insures constant operation while furnace repairs are being made. With the use of the auxiliary fire-box, the boiler is kept under pressure during the night and at other periods while the furnaces are not in operation. By keeping the boiler constantly under pressure and heat, the danger of breakdowns caused by contraction and expansion is minimized.

The boiler should be set as close as possible to the back bridge-wall of each furnace in order to utilize all the waste gas possible. This can be accomplished by setting the furnaces parallel to each other or at right angles to the boiler, which arrangement should be figured out to best suit local conditions. To take care of the tremendous amount of gases that pass through the boiler during the period of melting, it is advisable to set the boiler eccentric with the casing, leaving the greatest area on the front or steaming side of the boiler so that the extremely hot gases have a chance to rush up the front side and become effective nearer the top of the boiler. On the other hand, if the boiler tubes are set close to the casing, the intense gases and impinging flames will do most of their work on the tubes near the bottom of the boiler.

The water supply for a waste-heat boiler should be absolutely assured. It is best to have two independent sources of supply, since it is obvious that, if for any reason the water supply should fail, a heavy loss and probable calamity would result. To further insure continuous operation, all piping and valves should be extra heavy and erected with a great deal of care. In fact, expense should not be considered too largely in making the water and steam connections to a waste-heat boiler.

In the writer's opinion the most desirable use of a waste-heat boiler is when the full steam capacity of the boiler can be utilized. This can best be accomplished by using the waste-heat boiler in conjunction with a battery of hand-fired boilers, the steam pressure to be equalized and balanced by their use. In this way the waste-heat boiler serves as an auxiliary or a fluctuating source of steam supply to a boiler plant. If the steam line of a waste-heat boiler is connected directly into the steam log or header of the regular power-plant boilers, the hand-fired boilers can be run to the entire accommodation of the waste-heat boiler; that is, the hand-fired boilers can pick up the power load and carry it until the waste-heat boiler begins to come into service. Then the hand-fired boilers can be gradually slacked off and the fires banked, taking the full steam supply from the waste-heat boiler and thereby acting as a safety valve or regulator for it. It is apparent that in a waste-heat boiler there is no such thing as control of the steam supply. If all the steam that is made cannot be used, it has to be wasted.

A Word About the Care of the Boiler

A waste-heat boiler requires constant attention. It is most important to remember that the boiler is a fire-eater, and that to keep it on the ground the water supply must be *positive* and intelligently supplied. The boiler should be washed down and the tubes inspected for defects at least every three weeks, and the flues should be turbined, if necessary, not less than every six weeks. It is very important that treated water should be used to minimize the collection of boiler scale. Soot should be blown off the tubes at least three times a day. In fact, every possible care should be exercised to keep the tubes clean.

A 400-horsepower boiler connected with a 20-ton furnace operating at capacity will produce steam at the full capacity or a little in excess of the actual capacity of the boiler after the iron has been reduced to a semi-fluid state or say for 8 to 9 hours per day. There is no effect noticeable on the furnace operation and, in fact, the furnaces are operated entirely in disregard to the boiler connection. The fuel ratios do not change; neither do the furnace firing operations. In fact, the entire furnace conditions are absolutely normal, and should proceed in utter disregard of the boiler.

Another method of utilizing waste-heat is to set a boiler of convenient size alongside the neck of the furnace. With a variable speed induced-draft fan at the base of the boiler stack, sufficient gas could be diverted into the boiler to heat water or produce steam for various shop purposes, such as toilet uses, heating, etc.

Preparing Sand for Steel Foundry Work

Question:—We would like to obtain a good facing sand mixture for both green and dry sand molds for cast steel, and also a formula for a steel mold wash.

Answer:—In steel molding practice a sand is required that is sufficiently refractory to prevent fusing when in contact with the molten metal. Silica sand has been found to be satisfactory and its color largely is an index of its quality. The whiter the sand the purer, and consequently it is better adapted for making steel castings than a brown sand which is more fusible, although considerations of economy occasionally cause the latter to be preferred. Since silica sand is without bond, it is necessary to supply one artificially which is accomplished by mixing the sand with fire clay and molasses water and milling it in a pan mill to thoroughly incorporate these ingredients. A mixture of 10 parts silica sand and 1 part of fire clay, mixed dry with a sufficient amount of molasses water to temper the sand to molding consistency, will be found to be satisfactory. The sand can be varied in toughness by increasing or reducing the fire clay as desired until a mixture is obtained that may be considered satisfactory for the work to be molded. For a wash, use silica flour mixed with molasses water which should be sprayed or brushed onto the molds for skin dry and dry sand work. However, for green sand work, washes cannot be used.

T. H. Watson & Co., Ltd., Sheffield, Eng., announces the installation of a number of Greaves-Etchells electric furnaces in British plants. Kryn & Lahy, Letchworth, are now operating a 5-ton unit in making steel for munitions. A 3-ton furnace has been installed by the Tyne Electric Steel Castings Co. Thomas Andrews & Co., Sheffield, recently placed in operation a 1½-ton furnace designed to produce nickel chrome vanadium airplane and motor steels.

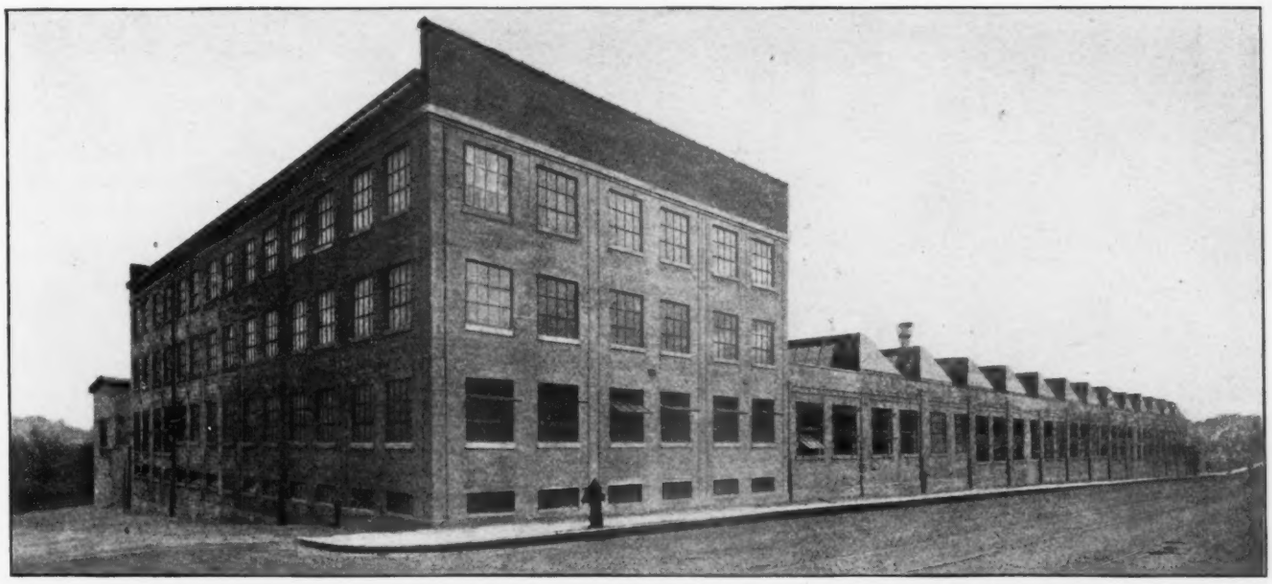


Fig. 1—Exterior View of the Lunkenheimer Foundry—The 3-story Building in the Foreground is Used for Pattern Storage

Cincinnati Foundry for Making Special Castings

Description of Equipment of New Foundry of the Lunkenheimer Co., Designed for Gray Iron, Malleable and Semisteel Castings

IN THE manufacture of engineering specialties, including various types of valves for high pressure steam and hydraulic work, it is essential that the materials be of high quality and great uniformity. This makes it necessary for the foundry which produces castings for these articles to be provided with facilities for making various kinds of mixtures in addition to the standard gray iron metal of which the majority of the castings are made. Therefore, when the Lunkenheimer Co., Cincinnati, decided to erect a new foundry, considerable attention was devoted to planning a shop in which gray iron, malleable iron and various forms of semisteel could be made. The plans materialized in a well-equipped and exceedingly modern foundry which was completed several months ago. So complete was the new plant in all its appointments that it was possible to shift the work from the old foundry to the new without interfering with the regular operation of the plant.

As shown in Fig. 1 the main building is a large single story structure of saw-tooth construction, approximately 100 x 250 feet adjoining the 3-story brick and concrete pattern storage. This building, shown in the foreground in Fig. 1, is designed to carry two additional stories which will be added when more space is required. As indicated in Fig. 2, the saw-tooth type of roof construction affords ample natural light for the molding floor, while the unusually large proportion of the walls, devoted to pivoted sash, provides a means of natural ventilation. Artificial lighting is provided

FIG. 2—VIEW OF MOLDING FLOOR SHOWING INDUSTRIAL TRACKS AND WOOD BLOCK FLOOR—THE CUPOLAS ARE SHOWN AT THE RIGHT

FIG. 3—TAPPING A CUPOLA—SHOWING THE METHOD OF CARRYING MOLTEN IRON TO THE MOLDING FLOORS

by means of mercury vapor lamps manufactured by the Cooper-Hewitt Co., Hoboken, N. J.

The main foundry is divided into four bays which extend north and south. In addition to the crane equipment, which will be mentioned later, materials may be handled in the molding room by trucks operating over the industrial track shown in Fig. 2. It will also be noted in this illustration that the floor is wood block installed by the Jennison-Wright Co., Toledo, O. Materials are delivered to the foundry over a siding of the C., H. & D., the main line of which passes alongside the foundry property. A locomotive traveling crane is used to move cars of material and to handle sand, coal, etc. Sand is stored in concrete bins. Practically all of the storage yard is paved with wood blocks which facilitate trucking of materials to and from the foundry.

Melting Equipment

Metal for the standard gray iron mixture is melted in two Newten cupolas built by the Northern Engineering Works, Detroit. The metal is passed into mother ladles carried on 4-wheel trucks running on the industrial tracks which extend to all parts of the molding floor and to the cleaning room. The molten metal is poured from the large ladles into hand-distributing ladles at convenient points in the molding room. The molds for heavier castings are made in the first two bays nearest the cupolas, and in pouring metal into these molds, it is taken directly from the large ladles suspended from cranes which serve these two bays. The electric traveling cranes were built by the Toledo Crane & Bridge Co., and are operated from the molding floor by ropes connected to General Electric control equipment on the crane bridges. In addition to the electric traveling cranes there are a number of chain hoists.

Malleable iron and semisteel are made in small, horizontal, cylindrical furnaces which were developed and designed by the Lunkenheimer Co. These furnaces, five of which appear in Fig. 5, consist essentially of a cylindrical shell of boiler steel securely bolted to castings whose ends are machined to roll on bearings, supported in heavy castings bolted to the floor. As shown in Fig. 5, the fuel oil and blast enter each furnace through a pipe suspended from the ceiling which terminates in a mixing chamber at a point opposite the center of the cast iron ends. Oil is used in connection with air to provide fuel for these furnaces. Two circular holes cut in the boiler plate shell of each furnace provide means for charging the material and for handling the molten metal. Each furnace is approximately 4 feet long and about 3 feet in diameter. When lined with fire brick and the necessary refractory materials, the capacity of each furnace is about 1200 pounds. A hand wheel in mesh with a

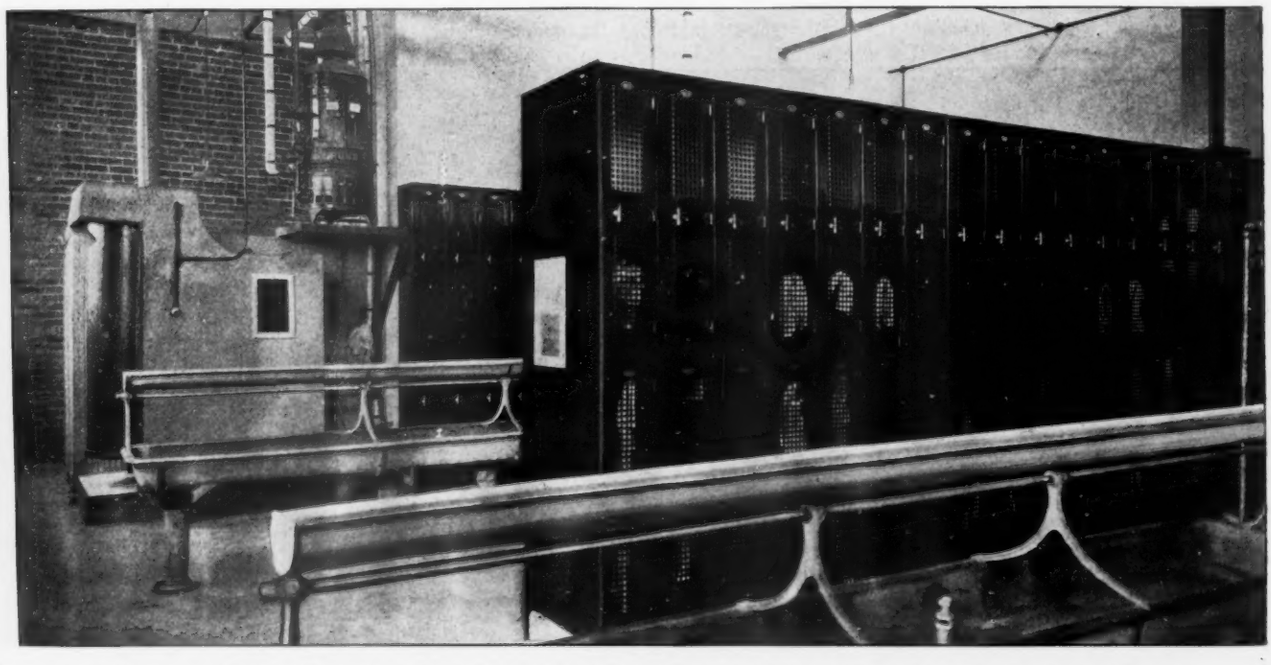


FIG. 4—A CLEAN AND WELL-LIGHTED WASH AND LOCKER ROOM IS APPRECIATED BY THE WORKMEN

FIG. 5—SPECIAL GRADES OF SEMI-STEEL AND MALLEABLE IRON ARE MADE IN THESE SPECIALLY DESIGNED FURNACES

large gear wheel on the left hand side of each furnace permits the operator to tilt the furnace from one side to the other, thereby tumbling the mixture. The furnace shells are designed so that they are interchangeable, making it possible to remove one shell from its supports and to substitute another in a short time.

On account of the small capacity of these furnaces and the facility for thoroughly mixing the metal, it is possible to make a wide range of mixtures. One of the most successful metals produced in these furnaces has been what is called puddled semisteel. This is made by charging the proper materials in the furnace, then puddling the metal in the usual manner and rocking the furnace by the hand wheel. It is claimed that whereas the ordinary mixtures of iron used by the Lunkenheimer company show a tensile strength of from 22,000 to 25,000 pounds per square inch, the puddled semisteel acquires a tensile strength of more than 35,000 pounds. By using the proper grade of malleable pig iron, it is possible to make small quantities of malleable iron in these specially designed furnaces. Castings made in this manner are annealed in a gas-fired annealing oven adjacent to the east wall of the foundry building.

A large proportion of the molds made in the Lunkenheimer Co. plant are made on molding machines. The machine equipment consists of power and hand squeezers, and power jar and hand squeezers made by the International Molding Machine Co., Chicago; Adams Co., Dubuque, Ia.; Tabor Mfg. Co., Philadelphia; Mumford Molding Machine Co., Chicago; Wm. H. Nicholls Co., Inc., Brooklyn, N. Y., and the E. H. Mumford Co., Lebanon, N. J. Sand is prepared by mixers made by Wm. Sellers & Co., Inc., Philadelphia; Blystone Mfg. Co., Cambridge Springs, Pa., and the Sand Mixing Machine Co., New York. Riddles made by the Champion Foundry Machinery Co., Chicago, are used.

Core Room

The core room is situated at the north end of the molding room building. Cores are stored on home-made racks on a small balcony. These racks are shown in Fig. 8. The racks consist of a 2½-inch extra heavy pipe to which steel castings supporting common wooden shelves are bolted. This type of shelving can be made at a minimum cost and provides an unusually large amount of storage space for a given floor area. The core ovens, which also are at the north end of the molding room building, are gas-fired. The ovens are of the drawer type, being equipped with 16 swing drawers on one side and a number of larger compartments on the other.

One of the most interesting features of the Lunkenheimer plant is the pattern storage building which adjoins the north end of the foundry. It is a 3-

FIG. 6—PATTERNS ARE STORED IN STEEL RACKS—THE STENCILED NUMBERS FACILITATE THE HANDLING OF PATTERNS

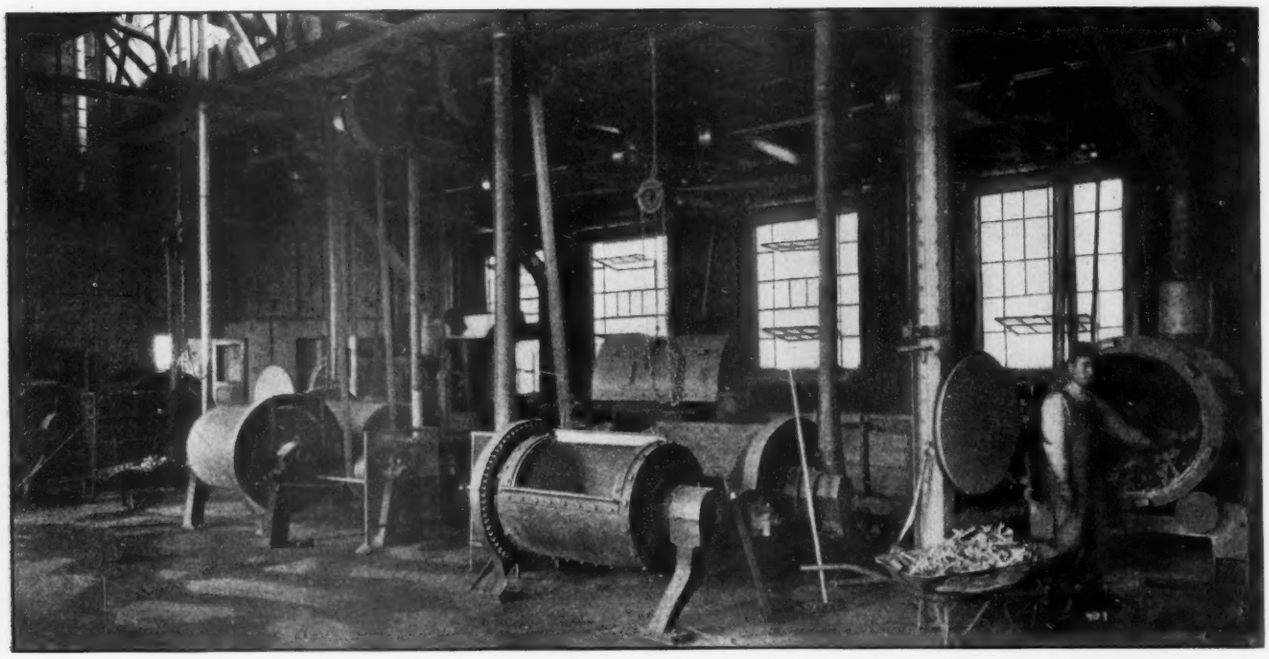


FIG. 7—A VIEW IN THE WELL-ARRANGED CLEANING ROOM—NOTE THAT THE SAND-BLAST MACHINES ARE AT THE ENDS OF THE ROOM, WHILE THE TUMBLING BARRELS ARE GROUPED BETWEEN THEM

story brick and concrete structure, protected by automatic fire extinguishers. Fig. 6, which shows a section of the shelving on which patterns are stored, conveys an idea of the neat appearance of every aisle in this building. As indicated in the illustrations, the steel shelving can be adjusted to accommodate any size of pattern, and the slides for pattern numbers facilitates the storage of patterns. It is interesting to note that in estimating the cost of steel and wood racks for pattern storage, it was discovered that the steel racks which were finally purchased, cost a few dollars less than wood racks strong enough to serve the same purpose. On account of the comparatively low ceiling of the floors in this building, the use of ladders is eliminated.

Cleaning Room

Fig. 7 shows a view of the cleaning room. The tumbling barrels are arranged in the center of the room, while the sand-blast machines are installed on either side. Chain hoists are provided to handle the doors of the tumbling barrels. The sand-blast machines were furnished by the New Haven Sand Blast Co., New Haven, Conn., and the tumbling barrels, by the W. W. Sly Mfg. Co., Cleveland, and the Whiting Foundry Equipment Co., Harvey, Ill. The grinding equipment consists of four double stand grinders made by the Norton Co., Worcester, Mass. Castings in the cleaning room are handled on industrial trucks made by the John C. Towsley Mfg. Co., Cincinnati.

In planning the new foundry, it was realized that well-ventilated and lighted working quarters are an inducement for employes to be more contented with their work. In line with this thought, the company has provided what is undoubtedly one of the best wash and locker rooms in any industrial plant in the country. Fig. 4 shows an interior view of the locker room which contains more than 150 steel lockers made by the Hart-Hutchinson Co., New Britain, Conn. A number of shower baths have been installed at either end of the room and hot water is provided for baths and wash basins by means of a Rudd heater shown in Fig. 4.

The new foundry was designed by Bert Baldwin & Co., engineers, and was built by Ross Bros., Cincinnati, contractors. The heating equipment consists of down-draft boilers and a radiator system installed and manufactured by the American Radiator Co., Chicago.

FIG. 8—HOME-MADE CORE RACKS OF COMMON PIPE, CAST BRACKETS AND WOODEN SHELVES

Melting Cast Iron in Crucibles

In a paper read at the annual conference of the Society of Chemical Industry, Birmingham, Eng., G. M. Walter stated that artificial gas is being largely used in metallurgical operations in the British Isles. The utilization of this fuel for metal melting has been greatly increased during the past 12 months and many thousands of pounds of brass, gun metal and aluminum are being melted daily with gas.

For the production and melting of aluminum alloys gas-heated furnaces are being employed that hold crucibles of 600 pounds capacity when melting copper and approximately 200 pounds capacity for aluminum. One of the more recent applications of artificial gas is in the melting of iron. In many instances cast iron is being melted in crucibles of 60 to 120 pounds capacity for the production of high-grade castings, and although the fuel costs are considerably higher than when using coke, the superior quality of the castings obtained more than justifies the extra fuel cost. In melting iron, about 700 cubic feet of artificial gas of a calorific value of 600 B.t.u.'s were required for each hundredweight of metal melted. The English hundredweight of 112 pounds is here indicated. From each crucible from seven to nine heats of iron were obtained.

Recently Developed Uses of Aluminum in Industry

The Ability to Weld and Roll Aluminum Has Been Responsible for Greatly Extending Its Application in Many Lines of Manufacture

By F G Shull

IN PREPARING a paper on this subject I have chosen to refer to the following materials, practically all of which have reached stages of commercial importance during quite recent years:

Aluminum foil.
Aluminum bottle caps and jar closures.
Manufactures, involving autogeneous welding.
Die and pressed castings.
Tubing for store service.
Rolled rod for machining purposes.
Aluminum conductors, steel reinforced.

The aluminum foil industry has grown from practically nothing to a volume of business involving many tons of aluminum annually. At the start, the product consisted principally of plain foil, not appreciably unlike plain tin foil in appearance, which was used for wrapping candies, chewing gum, teas and the like. Later on the development of the process for embossing and printing aluminum foil opened up a large field among manufacturers of chocolate bars, cheese, toilet soaps, etc., so that today a very considerable tonnage of this foil is being used in the embossed and printed form.

Plain foil is being used to some extent in electrical condensers. A most recent use for plain foil, which has, as yet, just barely started, is for the lining of pulp board cartons for the packaging of coffee. This combination package possesses moisture resisting, and oil retaining characteristics not inferior to the tin can, as a coffee container.

Aluminum bottle caps and jar closures, like foil, have advanced from a meager beginning to a business of substantial proportions during a very few years. They are being used on practically all food products put up in glass. While this seal possesses the nonrefillable feature and requires no opener to remove, it owes its success, in a great degree, to the fact that it is aluminum, which is known to be nonrusting and strictly hygienic.

The development of a process of welding aluminum by means of the oxy-hydrogen and oxy-acetylene flame has opened an almost limitless field for the outlet of aluminum. Sheet aluminum of all gages heavier than 1/32 inch can be readily welded and the seam dressed off so that it is difficult to locate the joint. Consequently, it is possible to build-up an aluminum tank or container of almost any size and shape which when welded together, is practically a one-piece job. This class of material finds a place in breweries, ginger-ale plants, milk depots, chemical plants, and, in fact, wherever seamless metallic nonrusting containers are used. The one-piece feature is of marked advantage over the riveted tank which is always liable to spring a leak.

For a long time it has been considered a difficult proposition to die-cast aluminum. At the present time, however, this problem seems to have been solved, as there are several companies that claim to be successfully die-casting this metal.

High Pressure Aluminum Castings

Another quite recent development is the subjecting of sand castings to very high pressures in order to render the metal more dense and to increase the strength. Such castings have found application in making parts for the timing devices of shrapnel, it being found that these castings not only possess extra high strength, but that they also machine exceptionally well.

Aluminum tubing for pneumatic store service is not a new field for aluminum, strictly speaking, since it has been gradually coming into use for the past several years. It is a fact, however, that the last few years have seen the volume of aluminum consumed for this purpose reach a stage where the tonnage involved is of great importance. The natural characteristics of the metal itself principally recommend it for this use.

One of the most interesting developments in the aluminum industry of recent years is the rolling of high alloy rods in practically all commercial sizes. In the past, commercial aluminum rod has been largely a drawn product. This method of manufacture prevented the use of aluminum alloyed with any appreciable percentage of other metal, for the reason that in the drawing operation the surface, principally, of the rod is worked. The result is that the surface becomes hard while the body of the rod is left comparatively soft. Therefore, only the smaller sizes of drawn rod are suitable for machining.

By the rolled method of manufacture not only is it possible to use highly alloyed metal, but also the process tends to work the entire mass of the rod so that the finished product is a good, uniform, homogeneous material which machines well throughout its entire substance. This process, therefore, makes available a good machining aluminum rod in all commercial sizes for automatic machine and turret lathe products.

One of the first uses for which this rolled rod was tried was for the machining of the fuse-timing parts for shrapnel. While it worked perfectly for this purpose, it so happened that the principal timing parts were of such a shape that in making them from rod it was necessary to cut away a great deal of the metal, resulting in high scrap loss. It was found that sand castings of the general shape of the parts to be made could be subjected to a comparison process and rendered highly satisfactory for this purpose, with a minimum of scrap loss. Consequently, as a commercial proposition, the rolled rod could not compete with the compressed castings for this particular article. It will without doubt, however, fine wide usage for automatic machine products.

Aluminum cable, steel reinforced, is not a very recent aluminum product, it having been in commercial use on an extensive scale for the past few years. It is, however, sufficiently little understood to seem to warrant reference being made to it under the title of this paper.

The excuse for the existence of such a product as steel reinforced aluminum cable lies in certain inherent characteristics of aluminum which needed improving in order to recommend its use for long span, high voltage work. The particular characteristic to which I refer is the coefficient of expansion of aluminum, which is approximately one-third greater than that of copper. Due to this greater expansion, the aluminum line lengthens a little more with temperature rise, and shortens a little more with temperature fall, than copper. The result is that it is necessary to string

Presented at the Boston meeting of the American Institute of Metals.

aluminum wire with greater sags than copper wire in order that its strength may not be overtaxed at low temperature. By allowing this greater sag at ordinary temperatures, combined with the higher coefficient of expansion of the aluminum referred to, one is apt to get excessive sags at extremely high temperatures in summer.

This was a condition of comparatively little importance in the early days of low voltages and short spans, but with the advent of higher voltage and long span steel tower construction, the characteristics of aluminum cable, as referred to, became a serious menace to its commercial existence.

What aluminum cable lacked was high tensile strength and low coefficient of expansion. In order to impart these characteristics it was proposed to make the center strand of a seven-strand cable, of steel, and the six outer strands, of aluminum, the steel to furnish the strength, and the aluminum the electrical conductivity. A very high grade plow steel wire was selected, which was triple galvanized to prevent corrosion, and the practical tests which followed proved that the theory was correct; that the composite cable took on characteristics different from either of the component metals, and was highly satisfactory for long span work.

It is found feasible to construct these cables with any standard number of strands, varying the proportion of steel and aluminum to meet the particular strength and sag conditions required.

Aluminum cable, steel reinforced, began to grow in favor from the start, so that today many of the most modern transmission lines on the American continent are built with this cable.

This, in a general way, will give a hint as to some of the more recent uses of aluminum. The automobile industry is, of course, the big factor in the aluminum business today, but the relative importance of some of the other fields for this metal seem to be in much greater demand than at any time heretofore.

Inspection of Brass and Bronze

By Alfred D Flinn and Ernest Jonson

IN 1913, extensive failures of wrought 60-40 brasses, or bronzes, so-called, began to be observed on a number of engineering projects in which these alloys of copper had been used in large quantities, as bolts, rods and plates. These failures have continued to come to the knowledge of the authors to the present time. Recently, the failures have not been so numerous, due in large part to the fact that at least in the project where the use had been greatest, the brass had been almost completely removed and steel substituted.

A number of failures of castings, due primarily to improper foundry methods, have occurred, and the form of failure was found to be cracks closely resembling season cracking of wrought brass. These were found to be due in all cases to repairs made by "burning-in" or welding and were proven to be of the same nature as season cracking. A few small castings of a broad U-shape failed by cracking apparently resulting from stresses set up by failure to afford opportunity for contraction during cooling. In the experience of the authors, correctly made bronze castings have been found highly satisfactory, and even some of the most imperfect ones have stood extreme abuse by hydrostatic and other tests without failure other than opening the incipient cracks so as to allow leakage.

Brass and bronze castings are expensive to make and, therefore, it is undesirable to reject such castings on account of defects which can be remedied. Minor leaks in hydraulic castings may be stopped by peening, but the fact that the casting leaks at a certain point generally indicates that the metal was defective at this point. If water comes through the walls of a casting, even in very minute quantities, under pressures which do not exceed 1000 pounds, this is an indication that the metal is not clean, or that the casting is porous from some other accidental condition. Peening, therefore, is a questionable method of treating defective spots in brass or bronze castings. If the defect is small and other circumstances permit, a hole may be drilled and a plug of the same metal as the casting may be screwed in. If plugging is not practical or permissible, defective spots should be cut out by chipping or drilling so that all the defective metal is removed. The cavity may then be filled by pouring metal into it from a crucible. In either case this must be done in such a way that the entire surface of the cavity is melted and thus consolidated with the added metal. If a gas flame is used, there is some danger of the filling not being solid, but if it is poured from a crucible with reasonable care, there can be no doubt about the soundness of the metal in the weld.

Cooling Stresses

Brass and bronze when stressed above the initial yield point for a considerable length of time, will fail by cracking, when oxidation takes place on the surface, which will happen sooner or later. When a defective spot in a casting is welded, the cooling of the metal in the weld will be accompanied by contraction which will put a tensile stress in the metal of the weld as well as in the old metal which surrounds it. If the metal of the weld is the same as that of the casting, its elastic limit may be appreciably higher than that of the rest of the casting, because the metal in the weld solidifies much more rapidly than the rest of the casting did originally. The permanent deformation resulting from the shrinkage of the weld therefore, will take place in the surrounding metal, and this metal will remain in a state of tension greater than its initial yield point and after a time cracks will appear. The magnitude of the stresses thus caused may be estimated from the fact that the shrinkage of brass from the freezing point down to ordinary temperature is about $\frac{3}{16}$ inch per foot or about 1.5 per cent. If the elastic limit were high enough, this shrinkage would produce a stress of not less than $14{,}000{,}000 \times 0.015 = 210{,}000$ pounds per square inch. In other words, the metal surrounding the "burn" will be stressed beyond the yield point. The "burn" itself, while stressed as high as the surrounding metal, may not be stressed to the yield point because, being chilled from pouring into the cold casting, it gets a higher yield point than the same metal cast in sand.

If the casting is of small lateral dimension, and the ends are not constrained, and the break extends all the way across it, the stress set up in the old metal by the shrinkage of the weld is compressive, and, therefore, there is no danger of cracking. In other cases shrinkage stress must be prevented by keeping the casting heated to a very high temperature while the weld is being made and until it has solidified. The yield point of the surrounding metal thus will be temporarily lowered and the flow will take place under a stress much lower than the yield point of the cold metal, so that there will be no danger of cracking after the metal has cooled. Another way to prevent cracking is to anneal the casting immediately after the

From a paper presented at the annual meeting of the American Society for Testing Materials, held at Atlantic City, June 26 to 29.

weld has been made. There is no reason to believe that the metal surrounding the weld is injured by the shrinkage stress until corrosion occurs on its surface. Therefore, if the yield point of the metal surrounding the weld is lowered by heating the entire casting to a sufficiently high temperature, additional flow will occur, and the cooling stress thus will be gradually reduced to a very small minimum, according to the length of time the annealing is continued. The annealing temperature should be maintained for several hours so as to give the metal time to flow.

There should be definite specification requirements to control the "burning-in" process. The specifications for manganese bronze castings should cover this point in such a way that absolutely safe castings will result, even when defective places have been "burned-in," merely by putting the specifications into the hands of a careful and experienced metal inspector who has no special familiarity with brass.

It now appears that the only way to insure safety in brass (bronze) castings is to specify annealing at a certain temperature for a certain length of time whenever "burning-in" has been done.

Brass and bronze castings are subject to various defects which are difficult to discover by surface inspection, or even by hydrostatic testing. The defect which most commonly occurs results from the inclusion of oxide in the metal of the casting. This occurs in two ways, either the molten metal contains an admixture of oxides, owing to insufficient protection of the molten metal from the air, or the dross from the surface of the crucible or furnace charge gets into the mold and is caught at some point where the flow is slight, and is thus prevented from coming to the surface in the risers. In the former case the entire casting is bad, and the best way to discover this defect is to make tensile tests on specimens cut from a coupon cast from the same melt. The admixture of oxide is indicated most distinctly by the greatly reduced elongation, but also by low ultimate strength. The tensile test therefore, should be specified for all important brass and bronze castings, no matter whether a certain strength and elongation are of mechanical value or not. The metal in every important brass or bronze casting should have the strength and elongation typical of the mixture of which it is made as an evidence that the metal in the casting is clean. If a tensile test is impracticable, oxidation in the metal may be discovered by making a bending test on a machined specimen. The presence of oxide then will be indicated by a number of small cracks which open on the outside of the bend, and if the oxidation is extreme, also by the abnormal color of the surface of the fractured specimen. Experience of the authors indicates that oxidation of metal in the crucible is a very common defect, especially of the mixtures containing high percentages of copper, that is, of the bronzes. It is the belief of the authors that in foundries where tensile or hydrostatic tests are not made, the metal is generally allowed to become considerably, and in many cases seriously, oxidized in the crucible, because this defect in the metal does not show on the surface of the casting. To specify bronze castings merely by the mixture therefore is useless. Unless the metal is tested after it has been poured, one is not justified in assuming that it consists of a clean, uniform mixture of the ingredients put into the crucible. A bronze casting may be made of the correct mixture and may show no surface indications of defects, and still it may be nothing but a honeycomb of metal, filled with oxide.

The presence of included dross is more difficult to discover. If a hydrostatic test cannot be made, it is practically impossible to find such defects unless they happen to come to the surface of the casting, and even a hydrostatic test does not always discover such defects, because there may be a considerable thickness of good metal along one or both of the surfaces of the casting. The best insurance against this kind of defect is correct molding, a thing which, strange to say, is unusual.

PROBLEMS OF THE BRASS FOUNDER

What To Do and How To Do It

Shrinkage of Aluminum Match Plates

Using No. 12 ingot aluminum for making match-plates, we find that the shrinkage is excessive. We recently made a plate, 11 x 18 inches, which was flat on the cope side and which was fed by four risers, 5/8 inch in diameter. This plate developed excessive shrinkage, notwithstanding the precautions taken.

Your trouble is due to insufficient feeding. A riser, 5/8 inch in diameter, is too small for this purpose. Furthermore, the head of metal thus obtained is too low to secure the requisite pressure since aluminum is approximately one-third as light as copper. A much higher head is required to get the same pressure in the mold. Therefore, it would be advisable to double the length of the sprues and risers and to increase the diameter of the latter to two inches. In some cases where the section of the metal on the plate is extra thick, it may be necessary to use risers three inches and more in diameter and to build them up several inches higher than the sprues. When the plate has been poured, the tops of the sprues are covered with sand and are weighted down and the risers are filled with molten metal to increase the pressure over the surface of the plate.

Bronze Substitute for Malleable Iron

We would like a mixture for a brass, bronze or aluminum alloy that will serve a similar purpose as malleable iron. The alloy should be difficult to bend but easy to machine.

The following alloy will be found suitable for the purposes outlined: Copper, 88 per cent; tin, 10 per cent, and lead, 2 per cent. If a cheaper mixture is desired, the following can be used: Copper, 60 per cent; zinc, 38 per cent, and lead, 2 per cent.

Aluminum Solders and Flux

We would like the formula for making an aluminum solder and information on the most desirable fluxes.

A mixture extensively used for soldering aluminum follows: Aluminum, 2.5 per cent; phosphor tin, 2.5 per cent; zinc, 27 per cent, and tin, 68 per cent. Melt the zinc and add aluminum, tin and phosphor tin.

The following mixtures also are used:

Aluminum, 10 per cent; copper, 5 per cent; zinc, 50 per cent; tin, 32 per cent, and phosphor tin, 3 per cent.

Tin, 80 per cent; lead, 17 per cent, and aluminum, 3 per cent.

Tin, 80 per cent; aluminum, 17 per cent; magnesium, 2.5 per cent, and nickel, 0.5 per cent.

Tin, 50 per cent; lead, 26 per cent; zinc, 23 per cent, and copper, 1 per cent.

Various fluxes are recommended for aluminum solders, one inventor preferring stearic acid, another oelic acid, 90 per cent and ammonia 10 per cent, while practical men applying solder use sulphuric acid to remove the oxide from the surface of aluminum and follow with tallow. A dozen different methods of soldering aluminum are being practiced and some creditable work is being done. Considerable skill and expense are required to produce satisfactory work and with these essentials taken care of, it seems immaterial what kind of an alloy is employed for soldering.

Brazing Metal

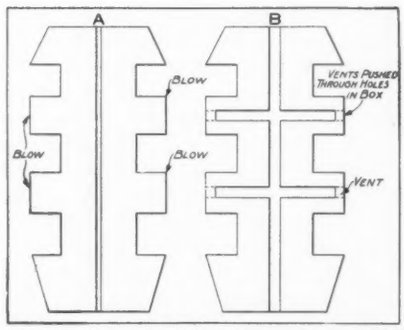
Kindly furnish us with a mixture for brazing metal. We are experiencing considerable difficulty in securing good castings made from the mixture we are using. While the castings appear to be sound, when machined, they are porous.

Since these castings melt easily while brazing it is evident that the mixture is at fault and that you are using a dip metal instead of a brazing alloy. The following mixture will withstand the brazing temperature without melting: Copper, 86 per cent; zinc, 12.5 per cent, and lead, 1.5 per cent. The lead is added to facilitate machining. Melt the copper quickly under charcoal, using a flux, such as bottle glass, to exclude the air and before the copper is melted add a small amount of salt. Deoxidize the metal with 0.25 per cent of 15 per cent phosphor-copper, stir thoroughly, add the zinc, which has been previously warmed, and follow with the lead. Use coarse sand for molding and coat the mold with plumbago. Provide heavy risers on all thick sections and if the castings have flanges, mold them with the face of the flange in the drag.

Venting Cores for Brass Work

We are experiencing difficulty with the cores shown in the accompanying illustration, since they blow at the points indicated. Our mixture consists of lake sand, 216 pounds; Albany said, 192 pounds; mill room sand, 216 pounds, and core oil and binding powder, 11 quarts. The cores must be made on end and, therefore, we must have a mixture that will prevent the sagging of the cores while baking.

Your difficulty is due to the insufficient venting of the core. If it could be made in halves, it could be more thoroughly vented, but since this is not possible, holes should be drilled in the core box at each of the extensions so that the cores may be vented horizontally to the center vent. The openings on the outside of the core should be filled after the core has been dried, to prevent the metal from entering these vents. However, before filling these openings, a vent wire should be passed through as a final precaution to ascertain whether or not the vents are closed and whether they are connected to the center vent. In the accompanying illustration, *B* is a sectional elevation of the core showing the proposed method of venting to avoid blowing, and *A* is a sectional elevation of the core showing the present method of venting.

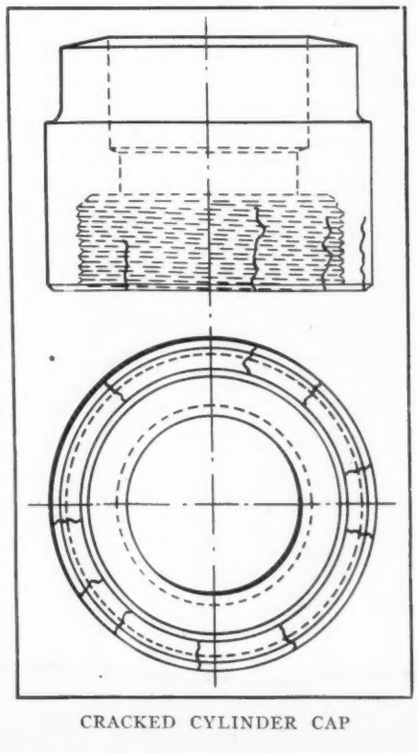


SECTIONAL ELEVATIONS OF A CORE SHOWING PRESENT AND RECOMMENDED METHODS OF VENTING

Brass Alloys for Piston Rings

We would like to obtain the formula of an alloy for a brass that is suitable for piston rings. These must pass over the end of the piston and spring to place in the groove.

There are two different types of alloys used for the purpose of making springs; one is a phosphor bronze, and the other is a yellow brass containing iron. As the latter metal is difficult to cast into bars, 3 inches in diameter, and to obtain clean castings, it will be necessary to use the following phosphor bronze alloy: Copper, 91.75 per cent; tin, 5 per cent; zinc, 2 per cent, and lead, 1 per cent. When the copper is molten, add 0.25 per cent of 15 per cent phosphor copper.



CRACKED CYLINDER CAP

Cylinder Caps Which Crack

We are experiencing considerable difficulty in casting the tubular well cylinder cap shown in the accompanying illustration. Cracks occur in the threaded ends. We use practically an all-scrap mixture which we do not ingot. Our mixture approximates copper, 65 per cent, and zinc, 35 per cent.

It is probable that by the use of chills the cracking of these castings might be obviated, since the chills would cause the thin section of metal to set rapidly. However, it might be advisable to make a softer core, particularly that section of it adjoining the section of the casting that cracks. If an oil sand mixture is being employed, change to a starch or rosin binder and even though this may slow up production the reduced casting losses will more than compensate for this increased cost. The chills will have to be applied externally in the form of a ring of brass or copper. Whether this is feasible, it is impossible to judge, since the casting may be molded in several ways. We are of the opinion that the use of chills will slow-up production so that even if the castings were more satisfactory, the gain would be very slight over the methods now in use with its attendant losses. Changing the cores to get them softer, either by burning them or by using a different binder, we believe is the more practical way of overcoming this trouble.

Aluminum for Cooking Utensils

We would like to know whether pure aluminum can be used advantageously for casting cooking utensils, or whether it can be used to better advantage when some other metal is mixed with it.

If it is your intention to produce cooking utensils regardless of cost, the purer the aluminum, the better. Tests have proven that no aluminum for this purpose should contain more than 2 per cent of impurities, but unless this metal is rolled into sheets and stamped to form, it will be too soft for the purpose mentioned. Cast aluminum utensils frequently contain a considerable percentage of zinc, as this cheapens the alloy. When the zinc content is high, however, the casting difficulties are increased. For the purpose mentioned, the following alloy has good casting properties: Aluminum, 82 per cent; zinc, 15 per cent and copper, 3 per cent.

Solving Foundry Transportation and Conveying Problems

Design and Application of Modern Labor-Saving Equipment for Foundries

By Robert E Newcomb

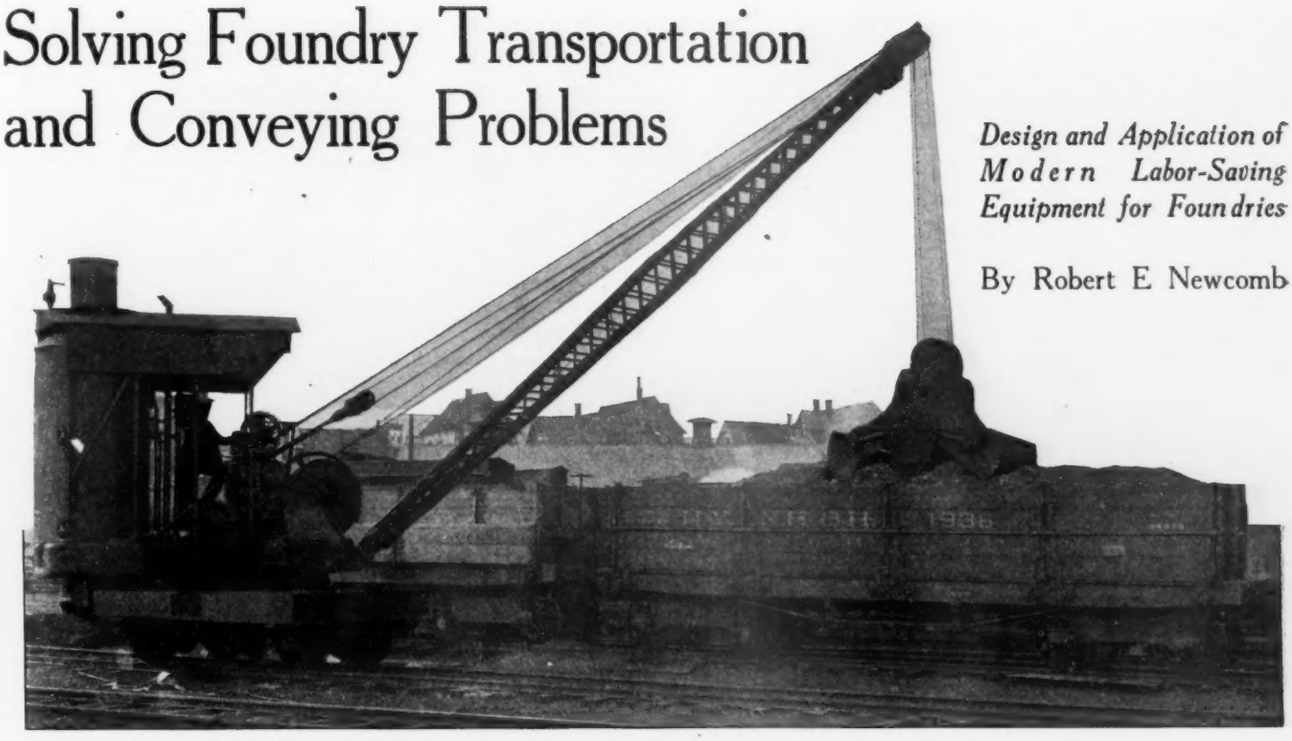


Fig. 1—Locomotive Crane and Bucket Unloading a Car

THE elimination of physical effort of the skilled mechanic or any other workman should increase his productivity. The introduction of the small molding machines of the squeezer type has generally been followed by the opposition of employes as the individual physical effort per hour is multiplied, though decreased, per mold.

The jar ram molding machine for the heavier side floor and crane floor work, has made a substantial reduction in the physical effort of the employe, while at the same time multiplying production.

The production of a molder or coremaker is in part limited by his physical capacity for work. It is further limited by the individual's adeptness and the patterns and core boxes supplied to him. Foundrymen are cognizant of this fact and some supply the best tools most conveniently accessible. Many foundry managers overlook the partial elimination of common labor. Notwithstanding the fact that the day laborer works for half the wages of a skilled mechanic, oftentimes his wages represent half the total labor cost of castings. This is especially true where skilled mechanics do laborers' work.

Methods of reducing labor effort through the elimination of ramming are important and have been described many times, hence this article is addressed to the foundryman wishing to reduce his common labor. In my experience, I have found that the foundry is one of the last places where the unskilled man wishes to be employed for the reason that the work is usually more laborious than many other employments, and further, due to organizations limiting the development of the laborer into a skilled mechanic.

Many foundry managers have been slow to apply mechanical equipment to reduce the cost of unskilled labor. Those who had the foresight to apply what other industries have used for some time have reaped a harvest. Foundrymen should be more familiar with the most common mechanical equipment, most important of which is the traveling crane.

Cranes and Their Application

A crane for the foundry should have smooth regular motion and for this reason the direct-current motor crane is preferable. More recently, the alternating-current motor crane has been applied to foundry service with satisfactory results, yet it does not give the same smooth action that is obtained from a direct-current motor crane. The alternating-current motor crane, however, has many advantages. The motor is of more simple construction and has no commutators and commutator brushes to wear and give trouble.

The motors of the direct-current motor crane should be thoroughly enclosed to protect them from the dust and dirt of the foundry. In fact, it is also well to specify enclosed alternating-current motors even though it increases the cost.

The controllers are the next most important part of the electrical equipment of the crane, hence the purchaser should consider them carefully, determine the number of points of control of the competitive cranes and the merits of the details of the design. Controllers should be of such size and shape and so located in the cage that they will not interfere with the operation or be an obstruction to the operator when handling loads almost beneath the cage.

The switch-board is of next importance, electrically, as on it is mounted main switches, fuses, circuit breakers, etc., by which current is properly distributed to the several motor circuits and automatically as well as manually disconnected.

Fig. 5 illustrates a three-motor crane cap made by the Pawling & Harnischfeger Co., Milwaukee, complete with switchboard controller and resistance. The roomy cage, orderly arrangement of controllers and location of resistance, is well illustrated.

A modern safety limit switch device is employed in the most modern cranes. A rising hook moves a switch lever to prevent overtravel of the hook and consequent damage. This is a most essential feature of a hoist and its reliability should be thoroughly investigated. If, through carelessness of the operator, the hook should be

Abstract of a paper presented at the twenty-second annual meeting of the American Foundrymen's association held at Boston, Sept. 24-28. The author, Robert E. Newcomb, is associated with the Deane Works, Worthington Pump & Machinery Corp., Holyoke, Mass.

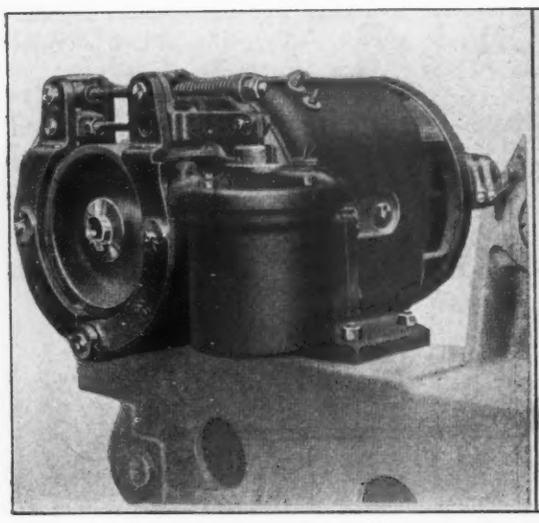


FIG. 2—DIRECT CURRENT MOTOR WITH CLAM SHELL BRAKE

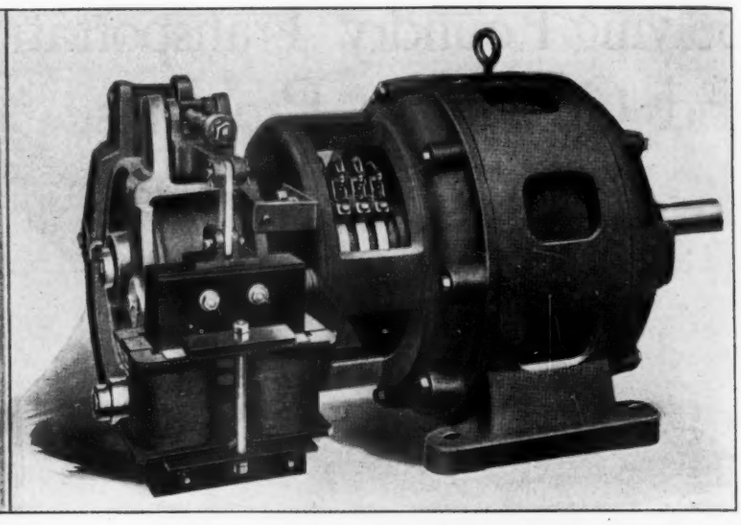


FIG. 3—ALTERNATING CURRENT MOTOR AND CLAM SHELL BRAKE

hoisted too high, an electric limit switch automatically interrupts the current and brings the motor to a quick stop. This switch, which is enclosed in a box and operated directly from the bottom block, carries only an auxiliary current which operates a magnetic switch, mounted on the switchboard. This magnetic switch, which carries the motor current, is provided with carbon arcing contacts and a powerful magnetic blow-out. After the limit switch has been opened by the hook, the load cannot be hoisted any further. However, it can be lowered in the usual manner, whereupon the limit switch will again close automatically. If for any reason the limit switch is not in operative condition, the magnetic switch will immediately open. This limit switch is called a closed-current type and is said to be absolutely dependable and foolproof.

Fig. 2 illustrates a common form of electric solenoid brake which automatically goes into service the moment the power is cut off from the circuit.

The bridge girders should be of ample stiffness and strength, well secured to the bridge end trucks by riveted gussets as shown in Fig. 4*a*, and which should be equipped with bearings of the Master Car Builders' type, similar to those shown in Fig. 4*a*, permitting easy removal and replacement of truck wheels and bearings. Fig. 4*b* illustrates the end truck construction employed by the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., in which the truck framing surrounds the wheels fitted to axles keyed into the hub. This construction illustrates self-oiling, self-aligning bearings set into openings in the truck frame and easily removable. This shows how to thoroughly enclose and protect from dust all bearings and gears. Bridge trucks should also be equipped with suitable bumpers to prevent damage or injury when bumping the end of the runway or other cranes, unless the bridge and frame forms a protection, as shown in Fig. 4*b*. Truck wheels should be steel castings and double-flanged or cast iron with chilled treads.

The crane trolley should be of compact construction and designed to resist or compensate for tortional movement due to inequalities in the track or runway. The hoist gearing should consist of machine-cut steel gears thoroughly enclosed and well supported between bearings, preferably operating in a bath of oil.

It is suggested that purchase specifications for traveling cranes contain the following clauses:

All trolley gears to be of open-hearth steel castings or of better material, and all pinions of suitable forged steel. Gears to be fully enclosed. Said enclosures and crane in general to be so constructed as to meet the most exacting requirements of the state industrial accident board or government authorities having jurisdiction therein, and the American Society of Mechanical Engineers code of safety standards for cranes.

Lubrication must be adequate and lubricating reservoirs and oil holes to

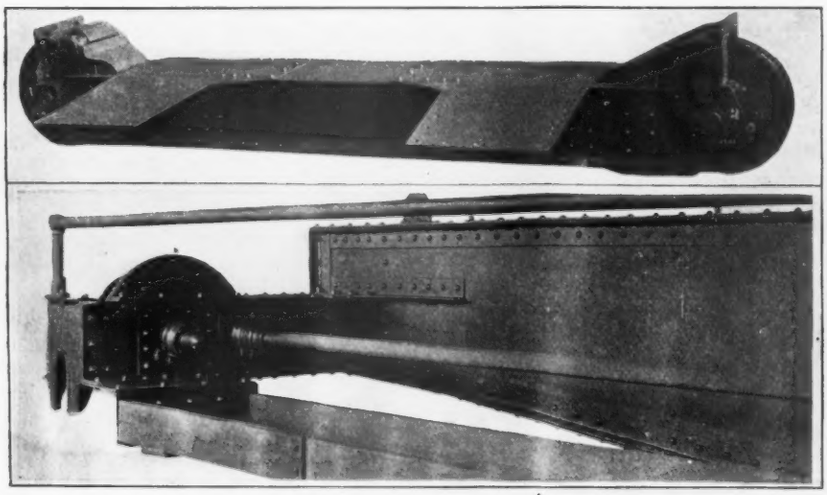


FIG. 4a—END TRUCK CONSTRUCTION SHOWING DRIVE AND ENCLOSED BEARINGS

FIG. 4b—END TRUCK CONSTRUCTION

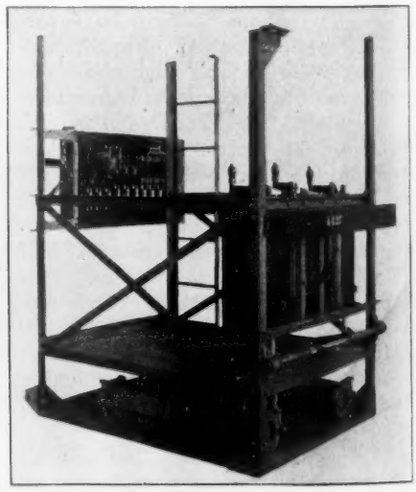


FIG. 5—CRANE CAB ILLUSTRATING ARRANGEMENT OF SWITCH-

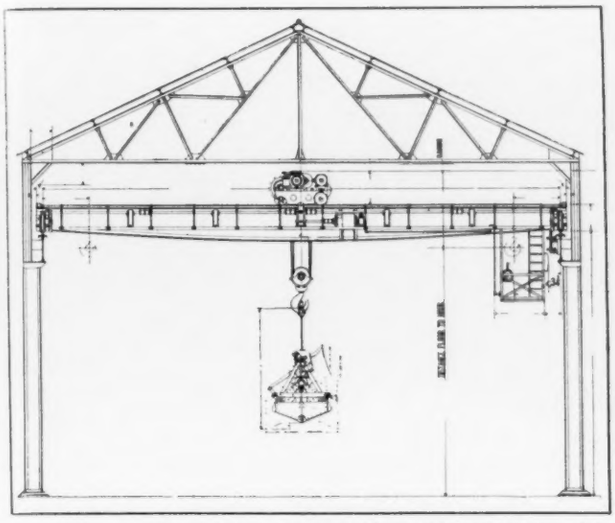


FIG. 6—PRACTICAL CLEARANCE DIMENSIONS OF BUCKET ON CRANE

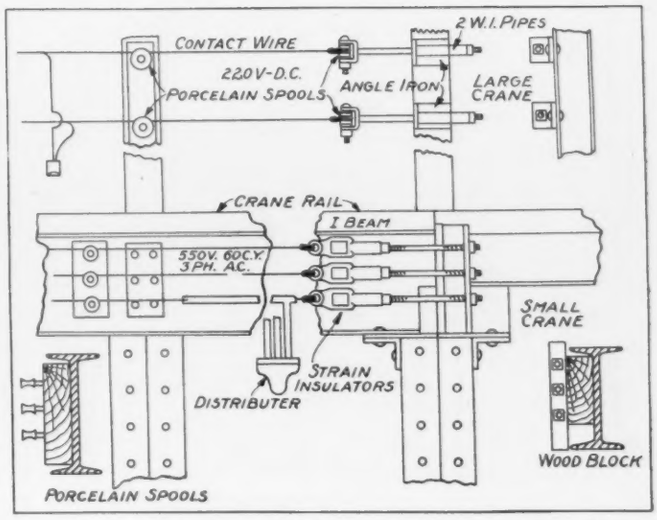


FIG. 7—METHOD OF SECURING AND SUPPORTING TROLLEY WIRES ON CRANE RUNWAY

be of such proportion as to insure a sufficient supply of lubricant reaching all parts to be lubricated. These parts should be so designed as to not require inspection or refilling more than once per day. All gears to operate in a bath of oil.

Wiring to comply with the rules and regulations of the National electric code of the National Board of Fire Underwriters and acceptable to the local electrical inspector having jurisdiction throughout the district where the crane is installed.

Crane to be guaranteed to the purchaser in design, workmanship and material. Guarantee to be good for one year from date of installation.

The foregoing clauses are somewhat rigid and some makers will not wish to comply with them. Nevertheless, they are desirable, as the manufacturers who object must acknowledge the inferiority of their equipment in these respects, hence, the selection may be made with a more complete knowledge of these essential characteristics of crane construction.

A Suggestion to Purchasers

It is suggested that purchasers determine by measurements, regardless of drawings, that they have ample runway clearance, as, frequently, building construction does not accurately conform to drawings. It is unsafe to purchase a crane having less than a 6-inch side and overhead clearance. See Fig. 6 for clearance dimensions required.

The crane runway wire should be of ample size for the addition of one or more cranes; it should be of hard drawn copper wire supported on insulators, as shown in Fig. 7.

The following illustrations show some of the more unusual applications of a traveling crane. Fig. 8 illustrates a single-line grab bucket, made by the Pawling & Harnischfeger Co., suspended from a crane hook. Fig. 9 illustrates the operation of a grab bucket in a foundry. These grab buckets are designed to hold from 1 to 1½ cubic yards and may be conveniently used for transferring such materials as molding sand in conjunction with sand-mixing machines.

A foundry melting 30 and 40 tons of iron per day has 75 to 100 tons of sand distributed upon the molding floors. It is customary for the molder to cut and temper this sand. The manual cutting and tempering of sands is a prolific cause of bad castings not easily controlled. The introduction of motor-driven portable sand-mixing machines, as shown in Fig. 12, may be operated and conducted by a specially trained operating crew with improved results. The machine illustrated was made by the Sand Mixing Machine Co., New York.

In other foundries, belt and bucket conveyors are used to return the sand to a central sand mixing and tempering plant, which is, of course, first rate practice as this quantity of sand may easily be handled to and from the molding floors at a cost not to exceed $0.01 to $0.02 per ton and within one hour's time. Such an equipment may cost from $20,000 to $25,000.

The same material may be moved to the central sand-mixing plant and returned to the molding floors with a grab bucket costing less than $3000 fully equipped with accessories except crane. The material may be moved during one hour following the heat and returned one hour before the starting time the following day at a cost not over $0.025 per ton of sand.

Additional Uses of Bucket

In addition the bucket may be used throughout the day for filling large molds, for excavating pits and for unloading incoming coke, coal and sand. A detail view of the Hayward bucket is shown in Fig. 11. This bucket is entirely controlled from the cage of the traveling crane.

The most undesirable and dirty part of the day's work in the foundry is dumping out castings, and for this work a magnet may be used with economical and satisfactory results, as shown in Figs. 13 and 14. Figs. 16

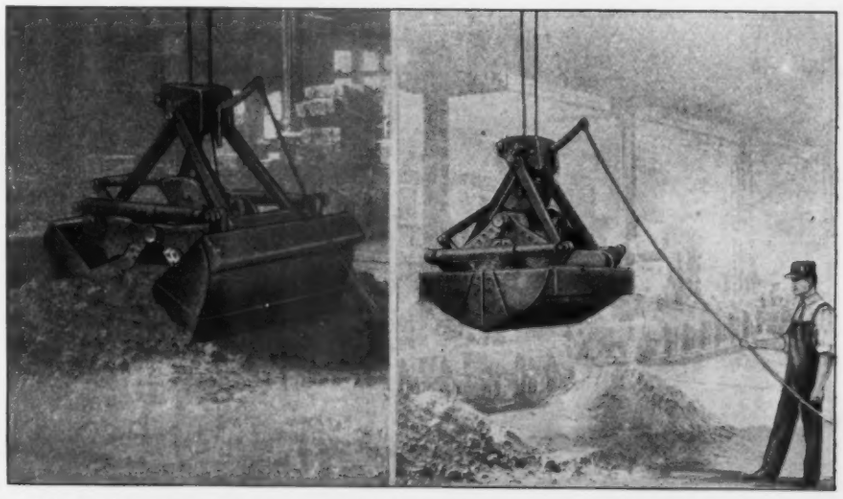


FIG. 8—CUTTING AND MIXING SAND WITH BUCKET. FIG. 9—GRAB BUCKET READY TO BE TRIPPED

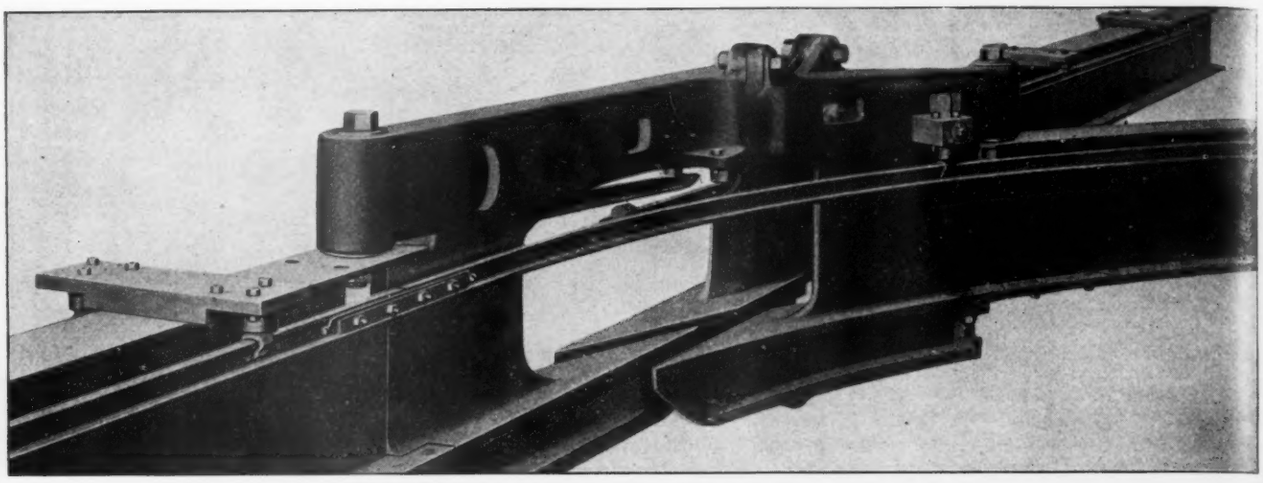


FIG. 10—FIXED TONGUE TRACK SWITCH FOR MONORAIL TRACK

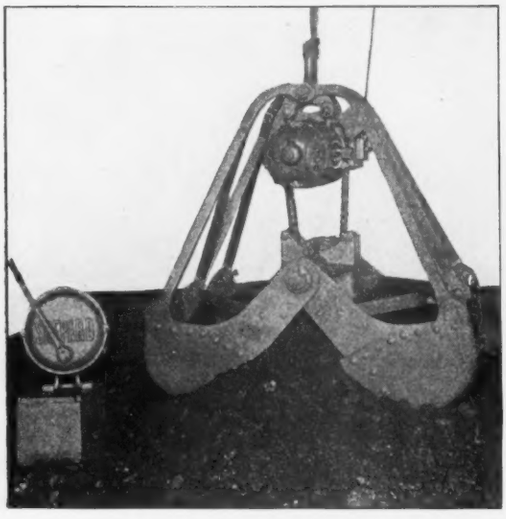


FIG. 11—MOTOR GRAB BUCKET HANDLING COAL

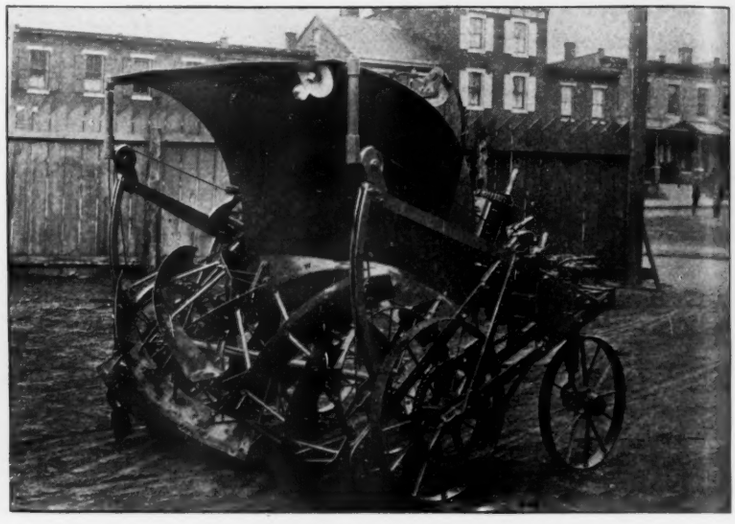


FIG. 12—SAND CUTTING MACHINE

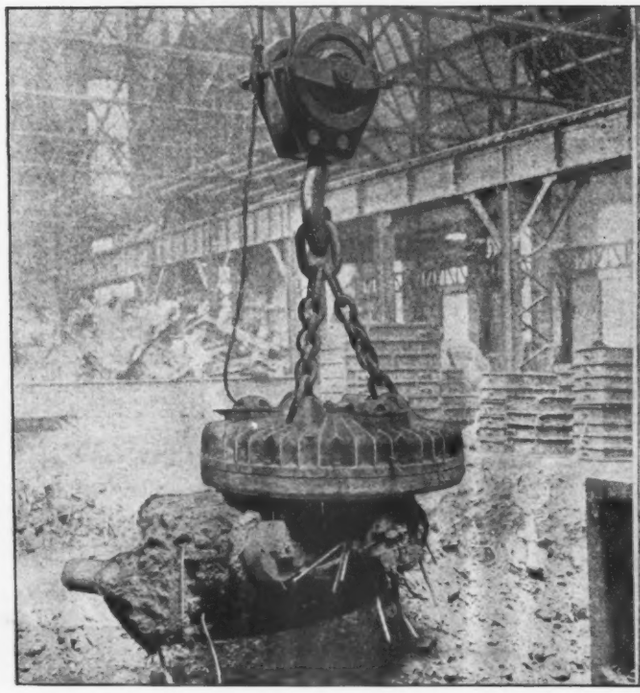


FIG. 13—HANDLING HOT CASTINGS WITH MAGNET AFTER SHAKING-OUT

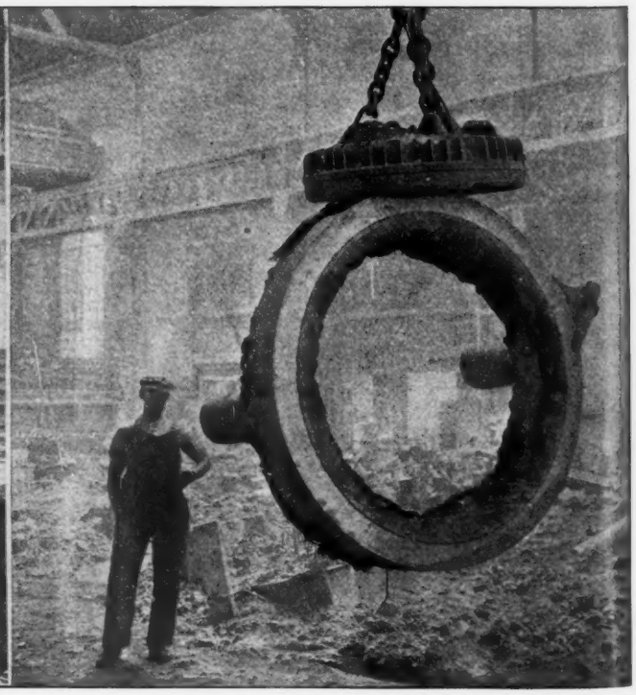


FIG. 14—CARRYING HOT CASTING WITH MAGNET TO CLEANING FLOOR

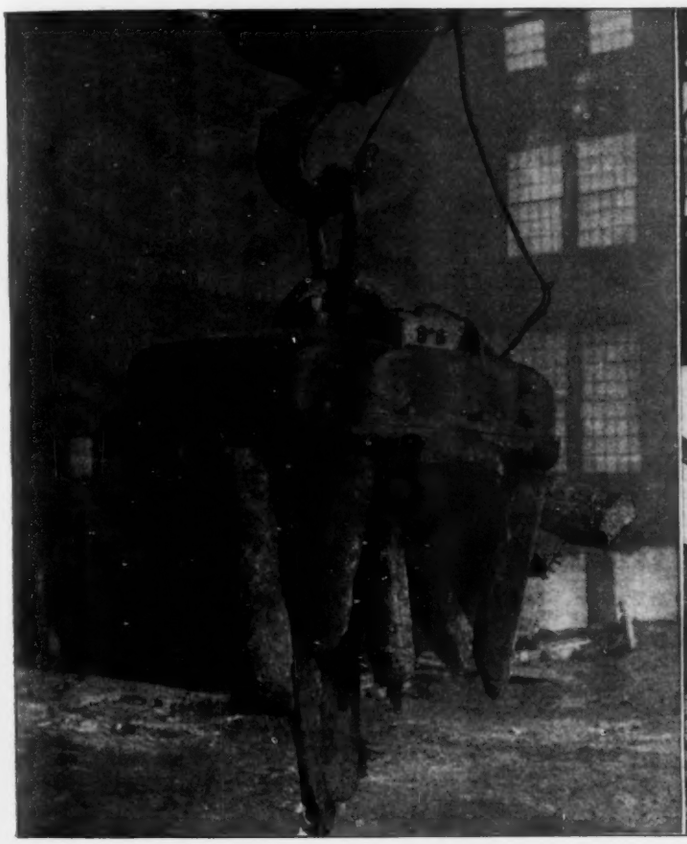


FIG. 15—HANDLING PIG IRON WITH A 43-INCH MAGNET

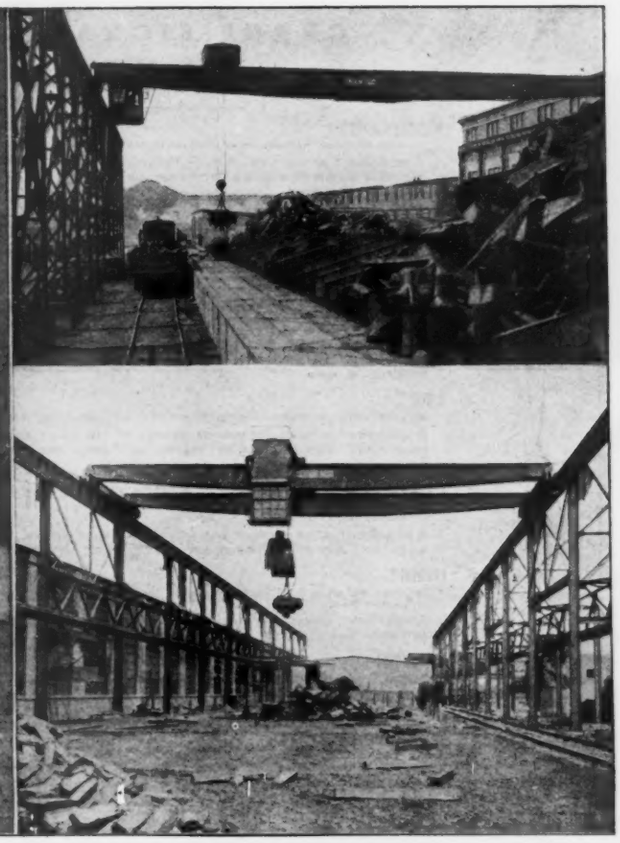


FIG. 16—UNLOADING PIG IRON WITH 62-INCH MAGNET.
FIG. 17—TRAVELING YARD CRANE EQUIPPED WITH 62-INCH MAGNET

and 17 show traveling cranes applied to yard work; in one instance both buckets and magnets are shown, indicating the ease with which material is here handled.

Jib or bracket cranes are of great value and relieve the overhead traveling cranes. Especially are they convenient and valuable when used in connection with the setting of cores. These cranes may be made to cover a large area, handling the work for several floors, and can be erected on any wall or post and may be swung out of the way of any work on the floor. They may be equipped with geared triplex blocks, air or electric hoists. Figs. 18 and 19 show views of electric and air hoists.

Fig. 22 illustrates a monorail system manufactured by the Shaw Electric Crane Co., Muskegon, Mich., applied in a portion of the J. I. Case Threshing Machine Co.'s foundry at Racine, Wis. In this system each monorail transfer bridge is equipped with a monorail hoist. This bridge is equipped with a latching device which is operated from the hoist cage. The entire unit may be operated as a three-motor traveling overhead crane. The controller for the bridge is placed in the hoist cage so that the bridge can be controlled from the cage. When it is desired to engage a spur track to allow the hoist to run off the bridge, the bridge is latched securely to the track before the hoist is run off. When the crane is engaged with

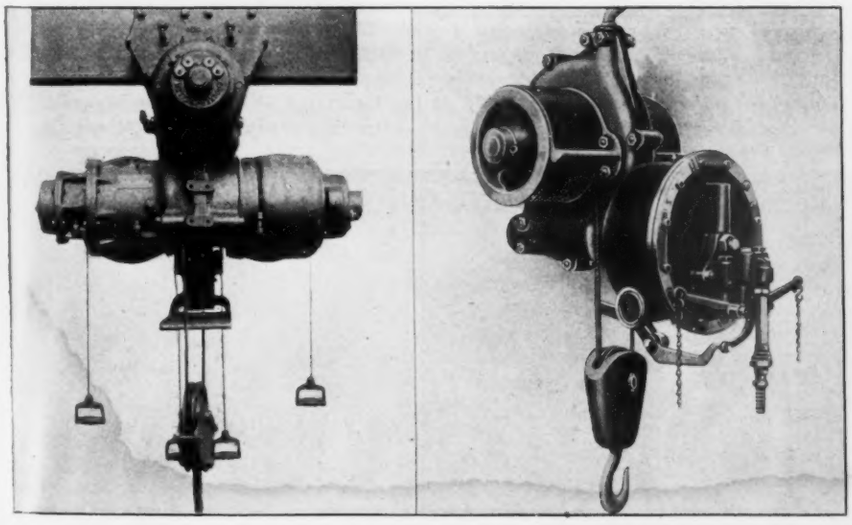


FIG. 18—ELECTRIC HOIST FOR SMALL LOADS. FIG. 19—AIR HOIST 2000 POUNDS CAPACITY

FIG. 20—3500-POUND CASTING HANDLED BY MAGNET

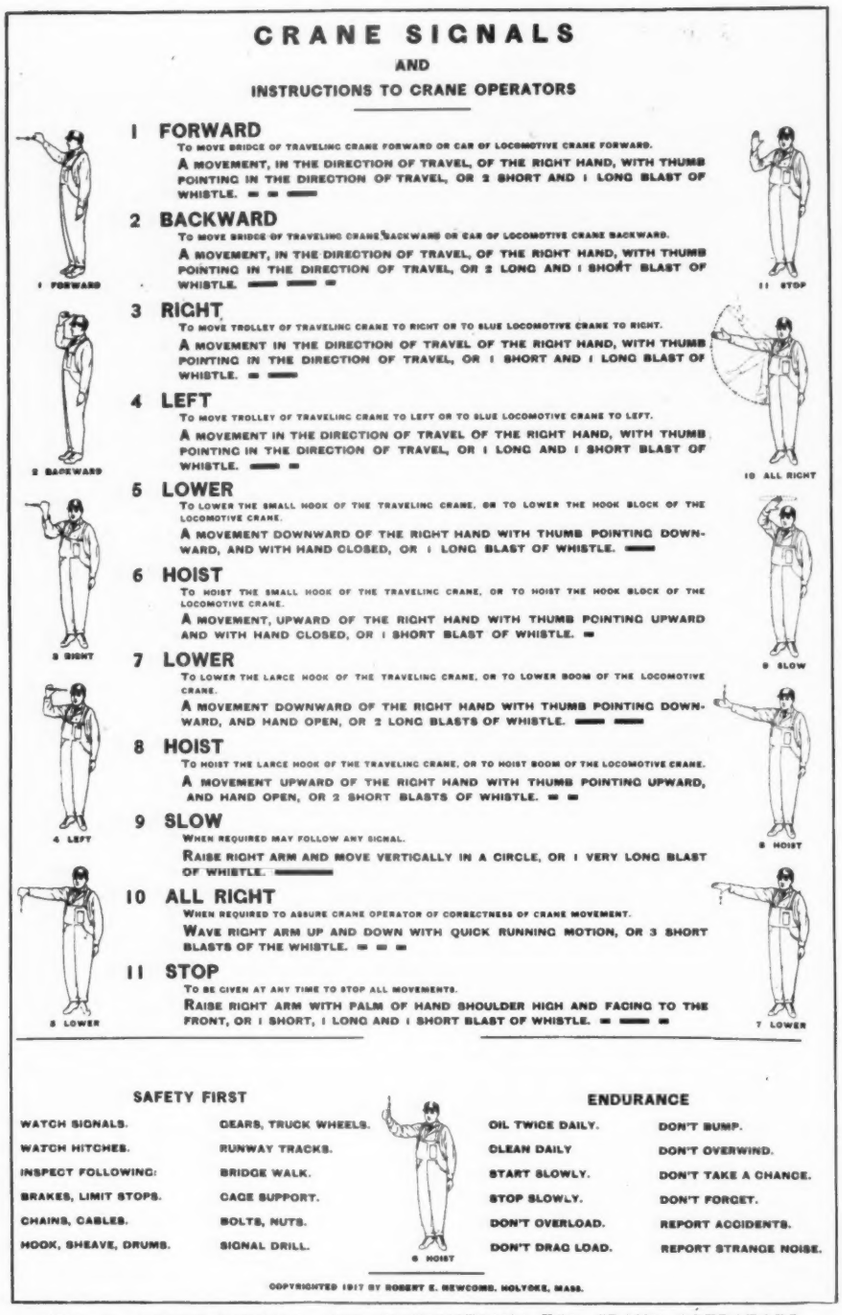

CRANE SIGNALS
AND
INSTRUCTIONS TO CRANE OPERATORS
1 FORWARD
To move bridge of traveling crane forward or car of locomotive crane forward.
A movement, in the direction of travel, of the right hand, with thumb pointing in the direction of travel, or 2 short and 1 long blast of whistle.
2 BACKWARD
To move bridge of traveling crane backward or car of locomotive crane backward.
A movement, in the direction of travel, of the right hand, with thumb pointing in the direction of travel, or 2 long and 1 short blast of whistle.
3 RIGHT
To move trolley of traveling crane to right or to slue locomotive crane to right.
A movement in the direction of travel of the right hand, with thumb pointing in the direction of travel, or 1 short and 1 long blast of whistle.
4 LEFT
To move trolley of traveling crane to left or to slue locomotive crane to left.
A movement in the direction of travel of the right hand, with thumb pointing in the direction of travel, or 1 long and 1 short blast of whistle.
5 LOWER
To lower the small hook of the traveling crane, or to lower the hook block of the locomotive crane.
A movement downward of the right hand with thumb pointing downward, and with hand closed, or 1 long blast of whistle.
6 HOIST
To hoist the small hook of the traveling crane, or to hoist the hook block of the locomotive crane.
A movement, upward of the right hand with thumb pointing upward and with hand closed, or 1 short blast of whistle.
7 LOWER
To lower the large hook of the traveling crane, or to lower boom of the locomotive crane.
A movement downward of the right hand with thumb pointing downward, and hand open, or 2 long blasts of whistle.
8 HOIST
To hoist the large hook of the traveling crane, or to hoist boom of the locomotive crane.
A movement upward of the right hand with thumb pointing upward, and hand open, or 2 short blasts of whistle.
9 SLOW
When required may follow any signal.
Raise right arm and move vertically in a circle, or 1 very long blast of whistle.
10 ALL RIGHT
When required to assure crane operator of correctness of crane movement.
Wave right arm up and down with quick running motion, or 3 short blasts of the whistle.
11 STOP
To be given at any time to stop all movements.
Raise right arm with palm of hand shoulder high and facing to the front, or 1 short, 1 long and 1 short blast of whistle.
1 FORWARD
11 STOP
2 BACKWARD
10 ALL RIGHT
3 RIGHT
9 SLOW
4 LEFT
8 HOIST
5 LOWER
7 LOWER
6 HOIST
SAFETY FIRST
WATCH SIGNALS.
WATCH HITCHES.
INSPECT FOLLOWING:
BRAKES, LIMIT STOPS.
CHAINS, CABLES.
HOOK, SHEAVE, DRUMS.
GEARS, TRUCK WHEELS.
RUNWAY TRACKS.
BRIDGE WALK.
CAGE SUPPORT.
BOLTS, NUTS.
SIGNAL DRILL.
ENDURANCE
OIL TWICE DAILY.
CLEAN DAILY
START SLOWLY.
STOP SLOWLY.
DON'T OVERLOAD.
DON'T DRAG LOAD.
DON'T BUMP.
DON'T OVERWIND.
DON'T TAKE A CHANCE.
DON'T FORGET.
REPORT ACCIDENTS.
REPORT STRANGE NOISE.
COPYRIGHTED 1917 BY ROBERT E. NEWCOMB, HOLYOKE, MASS.

FIG. 21—CRANE SIGNALS AND INSTRUCTIONS FOR CRANE OPERATORS

any of the spur tracks, all other tracks are locked by baffle plates, thus preventing any other hoist running out into the crane bay. When the bridge engages the spur track this baffle is automatically lifted, allowing the hoist to immediately run onto the bridge.

All gearing, with the exception of the truck gears, is enclosed in heavy dust-tight cases and is oil bath lubricated. The bridge is equipped with an electric brake, which automatically stops the travel of the bridge when the power is cut off from the traveling motor. This machine can be installed in the central bay with spurs leading to other parts of the plant and to unloading platform thus allowing flexibility in the operation and use of a monorail hoist. A unique feature of the system is said to be the fixed tongue switch.

The operation of this switch is such that under no conditions can it present an open end to the trolley, thus eliminating the possibility of an accidental derailment. Furthermore, this track-switch does not have to be set for the desired directions of travel; the operator does not have to stop and reach out to "throw" the switch. He selects his route by pulling a lever in the operating cage as he approaches the switch in the manner to be described. The trolley, therefore, runs through the track switch in any direction without stopping, thus avoiding all loss of time at the switches.

Considering the track layout, it is apparent that the introduction of a track-switch of the moving-tongue type impairs the continuity of the main track, since the track-switch may at any time be set for the spur track —a contingency for which the operator must be constantly on the alert. With the fixed-tongue system, on the other hand, both routes through the track-switch are always free. For these reasons it is entirely practicable to lay out a track system with as many track-switches of the fixed-tongue type as may be required, located wherever there is occasion to divide or divert the traffic, whereas with the moving tongue type, the introduction of track-switches is restricted by practical operating considerations.

Referring to Fig. 10, it will be seen that the steel castings composing

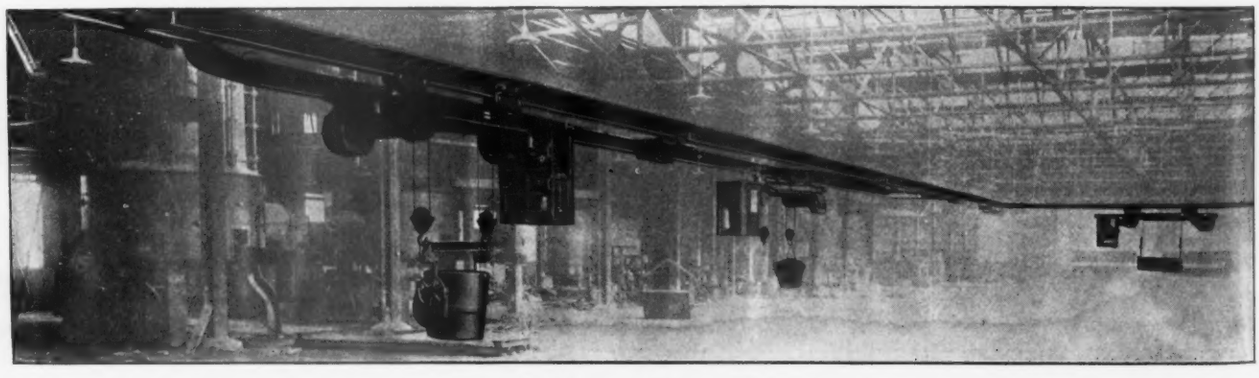


FIG. 22—MONORAIL SYSTEM IN FOUNDRY

the track-switch are formed with tread flange to correspond with those of the track beam and that these tread flanges are divided into three tongues by the two slots. The trolley has two four-wheel swivel trucks and as it runs through the track-switch one side of each truck passes through one of the switch slots, while the wheels successively cross the other slot. It should be particularly noted that in consequence of the angular position of the slot with reference to the direction of travel, wheels directly opposite each other in the truck do not cross simultaneously and that there are always two diagonally opposite wheels in proper position to carry the load. As the truck runs through the switch, therefore, the action is the same as if the track were continuous.

Selecting the Route

The manner in which the leading truck is steered onto the spur track is shown in Fig. 24, which is a sectional plan at the level of the lower flange of the I-beam, showing a right hand track-switch and the truck sides of the trolley. When approaching the track-switch with the intention of running onto the spur track, the horizontal roller T_2, located in front of the leading truck and known as the steering tappet, is raised by the steering lever in the cage and engages the curved flange B on the under side of the central tongue of the track-switch. In this manner the leading truck is swiveled and diverted onto the spur track. No steering operation is necessary to return from the spur track to the main track, nor to run through the track-switch in either direction on the main line.

The means whereby the rear truck is compelled to follow the leading truck onto the spur track is indicated in Fig. 25, the main portion of which corresponds to Fig. 24, while the auxiliary portion is a section (drawn to a larger scale) showing the rear truck and a portion of the trolley frame. Lines L, R and F are the center lines respectively of the leading truck, the rear truck and the trolley frame. When on a curve, the trucks swivel relative to the trolley frame, through an angle denominated A in the case of the rear truck and, as indicated in the auxiliary

12

WORTHINGTON PUMP AND MACHINERY CORPORATION
DEANE STEAM PUMP PLANT
CRANE INSPECTION REPORT

Make & Capacity of Crane NORTHERN 10 TON Mach. No 425 Date 6-14-17

INSTRUCTIONS TO INSPECTOR. Any dangerous condition shall be indicated by underscoring the report in red and inspector will definitely state whether he considers it necessary to shut down crane immediately or whether it be permitted to operate. He shall follow all repairs vigorously until the machine is right.

ELECTRICAL EQUIPMENT	Commutator or Collector Rings	Air Gap	Brushes	Grounds
Main hoisting motor	SMOOTH	1-.32"	O.K.	NONE
Auxiliary " "	SMOOTH	1-.32"	O.K.	NONE
Trolley travel "	SMOOTH	1-.32"	O.K.	NONE
Bridge " "	SMOOTH	1-.32"	O.K.	NONE

	Resistance grids	Contacts	Lost Motion
Main hoisting controller	O.K.	O.K.	SLIGHT
Auxiliary " "	O.K.	BURNED	CONSIDERABLE
Trolley travel "	O.K.	BURNED	CONSIDERABLE
Bridge " "	O.K.	O.K.	SLIGHT

LUBRICATION AND MECHANICAL CONDITION

Motor bearings, Main O.K. Auxiliary O.K. Trolley O.K. Bridge O.K.
Drum " Main SLACK Auxiliary O.K.
Gearing WORN BUT O.K. FOR PRESENT Hooks IN GOOD CONDITION
Hoisting cable or chain, Main GOOD Auxiliary O.K. BUT SOMEWHAT WORN

SAFETY APPLIANCES

Automatic Stop, Main TESTED AND FOUND O.K. Auxiliary TESTED AND FOUND O.K
Drum brake, Main TESTED AND FOUND O.K. Auxiliary TESTED AND FOUND OK.
Solenoid brake, Main TESTED AND FOUND O.K. Auxiliary TESTED AND FOUND OK.
Trolley travel brake NONE Bridge travel brake TESTED AND FOUND OK.
Runway stops BOLTS TIGHT AND O.K.

SUGGESTIONS OPERATOR SHOULD KEEP HIS CRANE CLEANER? USE OIL MORE GENEROUSLY ON DRUM BEARING AND LESS ON OUTSIDE. A NEW PINION ORDERED FOR THE MAIN HOIST? A NEW CABLE FOR THE AUXILIARY HOIST AND CONTROLLER, CONTRACTS FOR AUXILIARY HOIST AND TROLLEY REPLACED SATURDAY AFTERNOON.

(Signed) HENRY F. JONES
Inspector.

FIG. 23—REPORT OF CRANE INSPECTION

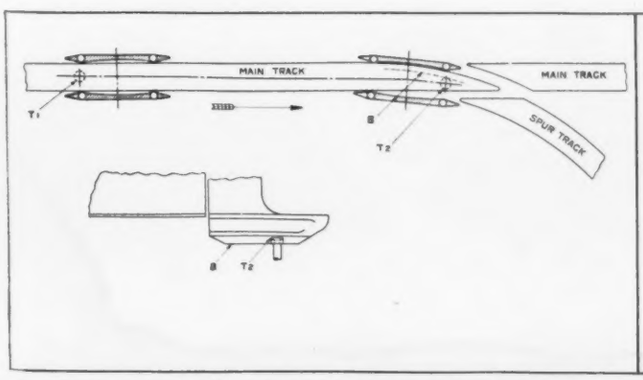


FIG. 24—STEERING THE LEADING TRUCK ON THE SPUR TRACK

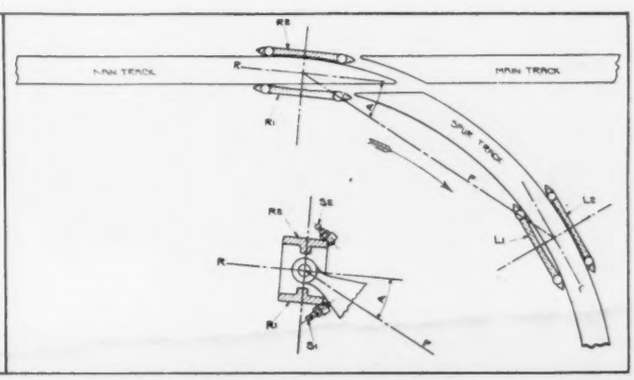
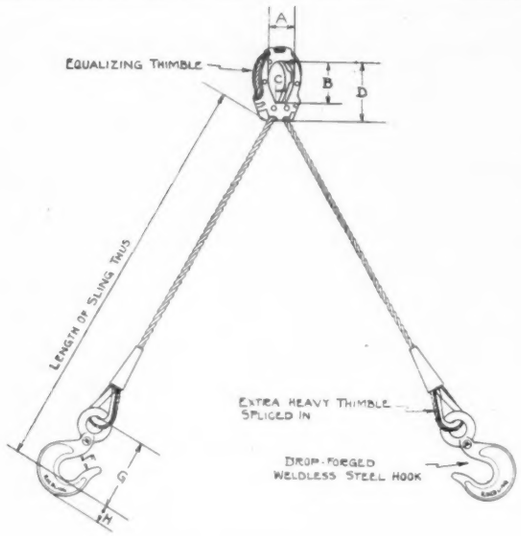


FIG. 25—METHOD OF STEERING THE REAR TRUCK ON THE SPUR TRACK



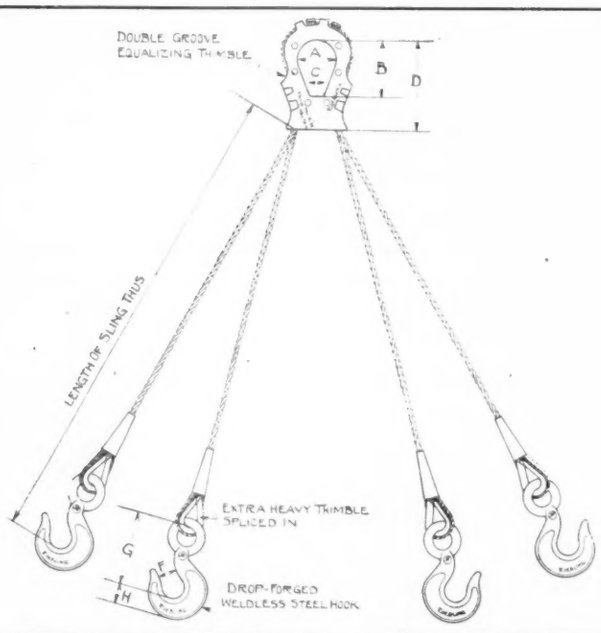
MAXIMUM SAFE LOADS, ETC.

WHERE ROPE DOES NOT COME IN CONTACT WITH THE MATERIAL HOISTED AS SHOWN IN FIG 1, PER "CS-168."

SAFE LOADS IN TONS OF 2,000 LBS

DIAM SLING	SAFE LOADS WHEN USED VERTICAL	SAFE LOADS WHEN USED 60° ANGLE	HOOK SIZE HOOK	HOOK F	HOOK G	HOOK H	EQUALIZING THIMBLES SET "M" A	SET "M" B	SET "M" C	SET "M" D	SET "L" A	SET "L" B	SET "L" C	SET "L" D	SET "SP" A	SET "SP" B	SET "SP" C	SET "SP" D
1/2"	3	2.5	25	1 1/2"	5 3/16"	1 7/16"	3 1/8"	5 1/2"	1 1/4"	7 1/4"								
5/8	4.5	4	30	1 5/8	6 7/16	1 3/4	3 1/8	5 3/4	1 3/8	8 3/8								
3/4	6.25	5.5	40	1 7/8	7 1/2	2	3 1/8	5 3/4	1 3/8	8 3/8					8	12	1 7/8	15
7/8	9	8	50	2 1/8	8 7/16	2 5/8	5 1/4	8	1 1/4	10 1/4	6 3/8	10 1/4	1 5/16	13	8	12	1 7/8	15
1	11.5	10	65	2 7/16	9 1/2	2 7/16	5 1/4	8	1 1/4	10 1/2	6 3/8	10 1/2	1 5/16	13	8 1/2	13	2 1/16	16
1 1/8	14	12	75	2 7/16	10 5/16	2 3/4	5 1/4	7 3/4	1 1/2	10 1/2	7	10 3/8	2	13 3/8	8 1/2	13	2 1/16	16
1 1/4	17	14.5	90	3	11 5/16	3	5 1/4	7 3/4	1 1/2	10 1/2	7	10 3/8	2	13 3/8	8 1/2	13	2 1/8	16 1/4
1 3/8	20	17	110	3 1/8	12 7/16	3 1/8	6	9 3/4	1 3/4	13	8 1/2	13	2 1/8	16 1/4				
1 1/2	23	20	125	3 1/4	13 3/8	3 1/2	6	9 3/4	1 3/4	13	8 1/2	13	2 1/8	16 1/4				
1 5/8	25	22	150	4 1/2	15 1/2	4	9	14	2	17 3/4								
1 3/4	29	25	175	5	18	4 1/2	9 3/4	15	2 1/2	19 1/2								

EQUALIZING BRIDLE SLINGS WITH HOOKS
"BLUE CENTER STEEL" ROPE

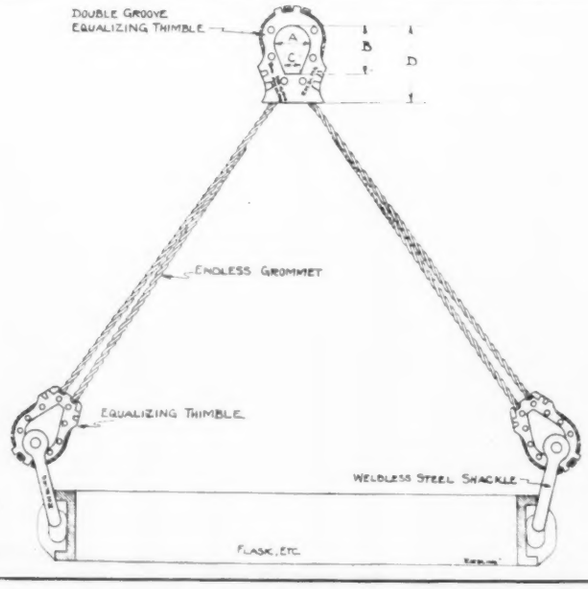


MAXIMUM SAFE LOADS
IN TONS OF 2,000 LBS.

WHERE ROPE DOES NOT COME IN CONTACT WITH THE MATERIAL HOISTED SIMILAR TO SLING FIG 1, PER "CS-168."

DIAM SLING	SAFE LOADS IN TONS WHEN USED 60° ANGLE	SAFE LOADS IN TONS WHEN USED 45° ANGLE	THIMBLE A	THIMBLE B	THIMBLE C	THIMBLE D	HOOK SIZE HOOK	HOOK F	HOOK G	HOOK H
1/2"	5	4.25	5 1/4"	7 1/4"	2"	11 1/4"	25	1 1/2"	5 7/16"	1 7/16"
5/8	8	6.5	5 1/4	7 1/2	1 15/16	11 7/8	30	1 5/8	6 7/16	1 3/4
3/4	11	9	5 1/4	7 1/2	1 15/16	11 7/8	40	1 7/8	7 1/2	2
7/8	16	12.5	6 1/2	8 3/4	2 3/8	14 1/4	50	2 1/8	8 7/16	2 5/8
1	20	16	6 1/2	8 3/4	2 3/8	14 1/4	65	2 7/16	9 1/2	2 9/16
1 1/8	24	20	8	11 1/4	2 3/8	17 3/8	75	2 9/16	10 5/16	2 3/4
1 1/4	29	24	8	11 1/4	2 3/8	17 3/8	90	3	11 5/16	3
1 3/8	34	28	9	12	3 1/2	19	110	3 1/4	12 7/16	3 1/8
1 1/2	40	32	9	12	3 1/2	19	125	3 1/4	13 3/8	3 1/2
1 5/8	44	35	10	13	4 3/8	20 1/2	150	4 1/2	15 1/2	4
1 3/4	50	41	10	13	4 3/8	20 1/2	175	5	18	4 1/2

EQUALIZING BRIDLE SLINGS WITH FOUR HOOKS
"BLUE CENTER STEEL" ROPE



MAXIMUM SAFE LOADS

WHERE ROPE DOES NOT COME IN CONTACT WITH THE MATERIAL HOISTED AS SHOWN WITH SLING HITCHED TO FLASK. FOR HOISTING UNDER MORE ADVERSE CONDITIONS, SEE ALSO "CS-149."

DIAM SLING	SAFE LOAD IN TONS OF 2000 LBS WHEN USED VERTICAL	WHEN USED 60° ANGLE	WHEN USED 45° ANGLE	THIMBLE A	THIMBLE B	THIMBLE C	THIMBLE D
1/2"	6	5	4	5 1/4"	7 1/4"	2"	11 1/4"
5/8	10	8.5	7	5 1/4	7 1/2	1 15/16	11 7/8
3/4	14	12	10	5 1/4	7 1/2	1 15/16	11 7/8
7/8	20	17	14	6 1/2	8 3/4	2 3/8	14 1/4
1	26	22.5	18	6 1/2	8 3/4	2 3/8	14 1/4
1 1/8	32	28	23	8	11 1/4	2 3/8	17 3/8
1 1/4	38	33	27	8	11 1/4	2 3/8	17 3/8
1 3/8	45	39	32	9	12	3 1/2	19
1 1/2	51	44	36	9	12	3 1/2	19
1 5/8	57	49	40	10	13	4 3/8	20 1/2
1 3/4	65	56	46	10	13	4 3/8	20 1/2

NOTE:- SHACKLES ARE DESIGNED TO SUIT MEMBER HOISTED

SHACKLE BRIDLE SLINGS
GROMMET CONSTRUCTION
"BLUE CENTER STEEL" ROPE

FIG. 26—TABLE OF SAFE LOADS OF BRIDLE SLINGS ISSUED BY JOHN A. ROEBLING'S SONS CO. FIG. 27—SAFE LOADS OF BRIDLE SLINGS WITH FOUR HOOKS. FIG. 28—SAFE LOADS OF BRIDLE SLINGS WITH EQUALIZING THIMBLE AND SHACKLE CONNECTIONS

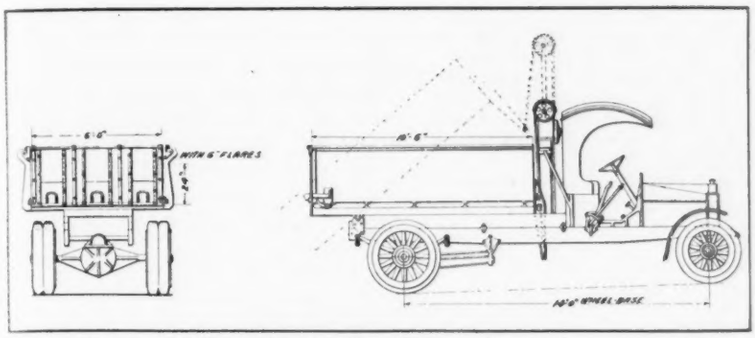


FIG. 29—TRUCK WITH STEEL DUMP BODY AND HYDRAULIC HOIST

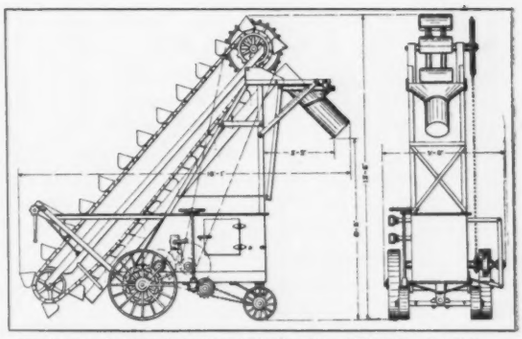


FIG. 30—TRUCK LOADER FOR CRUSHED STONE, SAND AND SIMILAR MATERIALS

diagram, angle A is limited by an adjustable set-screw S_1 in the trolley side R_1. Assuming both trucks to be on the main track and approaching the track-switch, the center lines L, R and F would then lie in a straight line and angle A would be zero. As the leading truck proceeds around the curve of the spur, the trolley frame swings around with reference to center line R of the rear truck and angle A increases. When the rear truck reached the point where the curve begins (approximately the position shown in Fig. 25) the frame castings engage the set-screw S_1 and angle A has attained its maximum value. As the trolley proceeds further, the frame castings slews the rear truck around and compels it to follow onto the spur track.

The diagram shows a right-hand switch, but it will be noted that set-screws S_2 in the truck side R_2 provides for the left-hand switches. It is, of course, also understood that the trolley travels either end ahead and that both trucks embody the steering feature and the set-screws.

Unloading sand and the disposal of foundry refuse is an important item in the cost of operating a foundry and may be frequently reduced by the use of a locomotive crane. A locomotive crane of 15-ton capacity at about 15-foot radius and 5-ton at about 42-foot radius is adapted for a foundry of 50-ton daily capacity. A purchaser should invariably purchase an 8-wheel crane mounted on a specially constructed, exceptionally heavy truck built of structural steel shapes and conforming to Master Car Builders' specifications. Such a machine will cost in normal times about $12,000, at present $18,000, and should be equipped with the following additionals:

One yard chain bucket	$ 800.00
One 45-inch magnet	1400.00
7½-kilowatt turbine generator	800.00

A locomotive crane and grab bucket, as shown in Fig. 1, illustrating a Brown Hoisting Machine Co. loco-

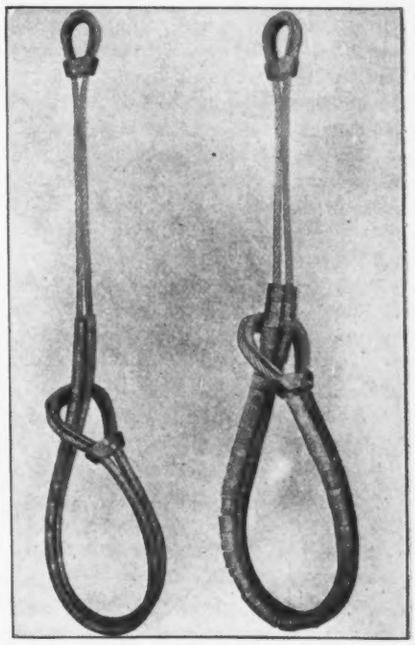


FIG. 32—TWO TYPES OF PROTECTED ANCHOR SLINGS

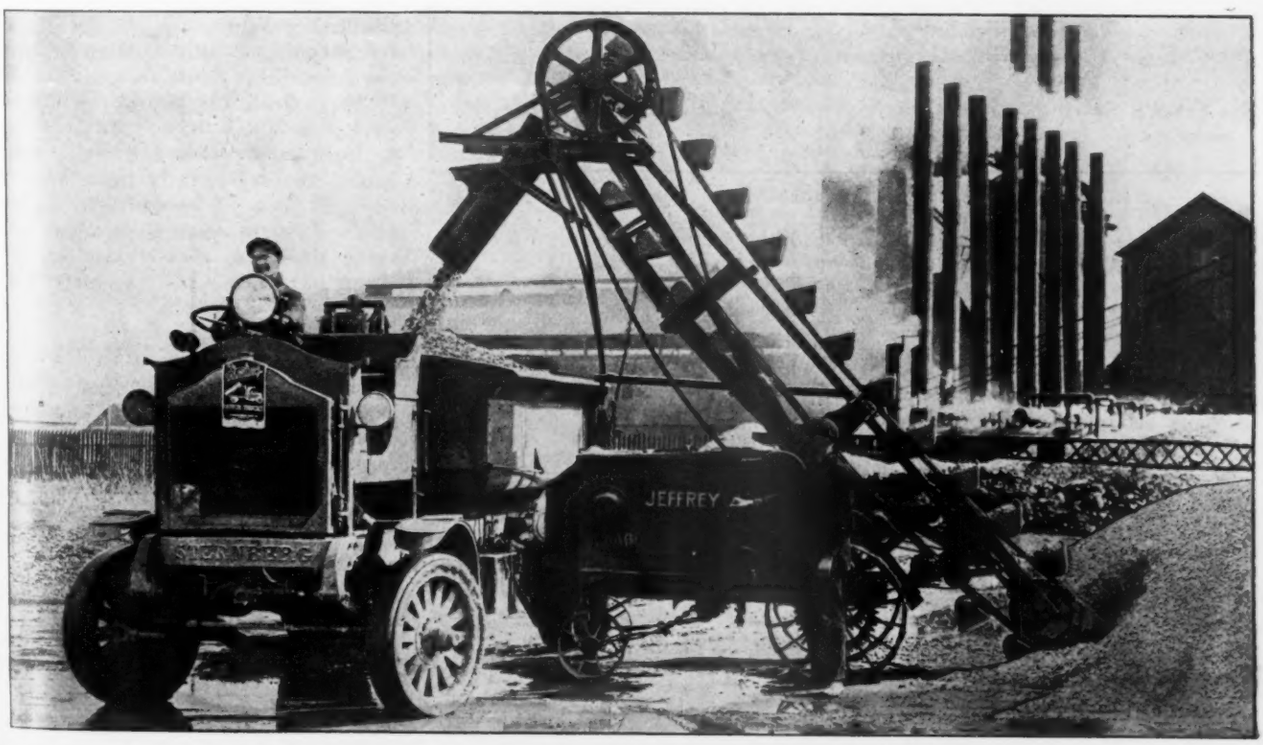


FIG. 31—PORTABLE WAGON LOADER, CAPACITY ONE TON PER MINUTE

motive crane and bucket, can unload a 40-ton carload of sand in 30 minutes. The same equipment may also be used for unloading coal and coke at a considerable saving over the usual hand methods. A 40-ton carload of pig iron or scrap may be unloaded in 50 to 60 minutes with a locomotive crane equipped with a lifting magnet. Figs. 15 and 20 show other representative views of lifting magnets used in connection with cranes. These figures illustrate the obvious saving resulting from the use of lifting magnets in connection with the locomotive and traveling cranes.

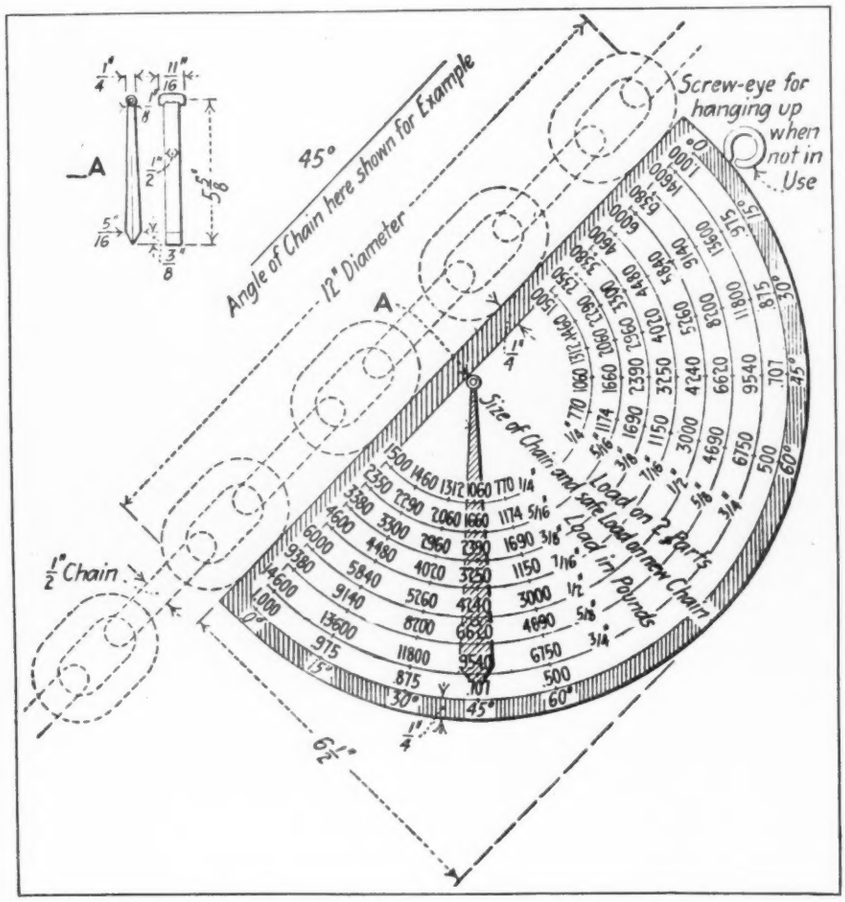

Screw-eye for hanging up when not in Use
45°
Angle of Chain here shown for Example
12" Diameter
A
Size of Chain and safe Load in new Chain
Load in Pounds on 2 parts
1/2" Chain
6 1/2"

FIG. 33—SAFE-LOAD GAGE FOR CHAIN AND ROPE SLINGS

Crane Operation and Maintenance

The use of cranes and hoisting devices require careful thought and attention. All chains and cables should be inspected regularly and carefully for flaws or defects. Sling chains of suitable strength should always be used. Selection is usually left to the judgment of the employe making the hitch. A method to train him and provide him with information so that he will know just what he is doing was devised by F. W. Salmon and described as follows in the *American Machinist* of Jan. 16, 1916:

"The illustration (Fig. 33) shows a gage by which the safe load on a chain or wire-rope sling may be obtained for any angle of sling from the vertical to 60 degrees, by either placing the gage against the sling, as shown, or holding it at a distance at such an angle that its upper edge coincides with the axis of the sling part. It is suitable for all the usual sizes of chain or wire rope, provided they are in good condition.

"It is simply a light, seasoned-wood frame *A*, about 1 foot long and ¾ inch thick, cut out on a jig-saw. In the center of this frame is freely suspended a small, heavy pendulum. Transparent celluloid is put on each side of the frame, and on this are marked the graduations for the safe loads for chains on one side, for ropes on the other.

"The very fact that such an instrument is in the shop and frequently used will lead the men to be more careful, give them a better idea of the effect of the angles on sling chains, and lead them to become better informed on the strength of slings and the weights of the pieces commonly lifted."

At the Deane works of the Worthington Pump & Machinery Corp., each sling is marked with its capacity, and this with other similar precautionary measures has established a record of no serious accidents from the use of hoisting apparatus. Figs. 26, 27 and 28 are reproduced from John A. Roebling's Son catalog and give similar data with the reference to the use of steel rope slings. Fig. 32 shows a type of sling in which the wire is armored or protected against direct contact with the object lifted.

Sometimes a frequent and just criticism of many molders is inadequate and poor crane service. Crane service may be improved by the use of standard signals and suitable instructions to crane operators. As a suggestion, the crane signals in use at the Deane works of the Worthington Pump & Machinery Corp., shown in Fig. 36, are submitted.

Another cause of improper service of cranes is their frequent stoppage for repairs. Cranes constructed and designed along the lines of those described should have very few stoppages for repairs. However, to guard against such stoppages, the Deane works of the Worthington Pump & Machinery Corp. has used to advantage the crane inspection report shown in Fig. 37, which is filled out weekly.

To Require Reports

Ultimately, the state board of labor and industries of Massachusetts and other states, may require the foundries to fill out a similar report for all cranes and hoisting equipment. To further establish the safety of cranes, the code of safety standards for cranes of the American Society of Mechanical Engineers should be thoroughly studied and the practice there recommended, used. "Safe Practices", published by the National Safety Council, Vol. 1, No. 6, is a valuable treatise on the practical and safe application of the use of ropes, cables and chains.

Foundry sand, especially core sand and sand refuse, may frequently be handled conveniently by an automobile truck equipped with a dumping body similar to that illustrated in Fig. 29. A 5-ton truck of this type will cost, equipped, about $4500; will make 12 to 15 miles per hour and may be unloaded almost instantly and loaded in three to four minutes with a gas engine or motor-operated loading machine similar to that shown in Figs. 30 and 31, which costs from $900 to $1000.

Bucket Conveyors Expensive

Belt and bucket conveyors have been used to some extent in foundries, especially two-story foundries and continuous pouring foundries. The expense, however, is usually too large for them to be considered for the foundry doing the usual class of jobbing work, and therefore, I have not shown illustrations depicting the use of the belt or bucket conveyors.

The foregoing suggestions on the use and the operation of hoisting and conveying devices have proved of value and merit careful thought for foundrymen endeavoring to stem the rising tide on operating costs.

Personal

W. Karl Hilbrich has been appointed purchasing agent of the Erie Malleable Iron Co., Erie, Pa.

G. W. Ketter, recently associated with the British Forgings Co., Ltd., Toronto, Ont., has joined the staff of the Electric Furnace Construction Co., Philadelphia.

Charles K. Logue has been appointed foundry superintendent of the Albany Car Wheel Co., Albany, N. Y. Mr. Logue was formerly associated with the Barney & Smith Co., Dayton, O.

Charles F. Hall, structural and mechanical engineer, has joined the staff of the Booth-Hall Co., Chicago, manufacturer of electric steel furnaces. Mr. Hall will be employed in the capacity of production manager.

F. D. Egan, for the past seven years steam and electrical engineer of the Midland plant of the Pittsburgh Crucible Steel Co., has become works manager of the Pittsburgh Iron & Steel Foundries Co., Midland, Pa.

David Lofts has been appointed senior chemical engineer of the American Steel Foundries, Chicago, to succeed J. S. Goddard, who died about a year ago. B. C. McFadden has been appointed assistant to Mr. Lofts.

Frank Wharton Brooke, formerly metallurgist with the John A. Crowley Co., Detroit, and the Ludlum Steel Co., Watervliet, N. Y., has joined the staff of the Electric Furnace Construction Co., Philadelphia.

E. R. Swanson has accepted the position of superintendent of the Duquesne Steel Foundry Co., Coraopolis, Pa., succeeding L. A. Way, resigned. Mr. Swanson was formerly assistant superintendent of the Commonwealth Steel Co., Granite City, Ill.

R. L. Browne recently has become associated with the sales department of the Goldschmidt Thermit Co., New York, in the capacity of commercial engineer. Mr. Browne spent several months in the foundry of this company, acquiring a practical knowledge of the thermit process of welding.

Stanton Griffith has accepted the position of works manager of the South Side Foundry & Machine Co., Charleston, W. Va. For the past 15 years Mr. Griffith has been superintendent of the foundry, pattern shop and chemical laboratory of the Fairbanks-Morse Mfg. Co., at Beloit, Wis.

Russell R. Clarke, formerly superintendent of the Brass Foundry operated by the Pennsylvania Lines West, Northside, Pittsburgh, and more recently affiliated with the Johnson Bronze Co., New Castle, Pa., in an executive capacity, has accepted the position of superintendent of the new plant of the Eagle Brass Foundry, Seattle.

Bert Cushman, who for a number of years has been foundry foreman of the Maxwell Motor Co.'s foundry at Dayton, O., has been appointed superintendent of the Fairview Foundry, Detroit, formerly owned and operated by the Chalmers Motor Co., which company is now a part of the Maxwell Motor Co., Inc. George Wise succeeded Mr. Cushman as foundry foreman of the Dayton plant.

Death of Frank H. Zimmers

Frank H. Zimmers, long prominent in Pittsburgh foundry circles, died at the Presbyterian hospital, Pittsburgh, Oct. 23, of pneumonia. He acted as secretary of the Pittsburgh Foundrymen's association since its organization, more than 20 years ago. Mr. Zimmers was born at Blairsville, Pa., 58 years ago. At the age of 16 he joined the engineers' corps

FRANK H. ZIMMERS

of the Baltimore & Ohio railroad and after serving two years in this capacity, became associated with the Pennsylvania railroad, having charge as stationmaster of the Fourth avenue depot in Pittsburgh during the railroad riots in 1877. Returning to Blairsville, Mr. Zimmers engaged in the shoe business, which he conducted for eight years. Coming again to Pittsburgh, he became associated with the Union Foundry & Machine Co. and remained with that company until three years ago, when he resigned as its secretary. He then became affiliated with the National Steel Castings Co., New Cumberland, W. Va., as sales manager. He was also representative of the Weir & Craig Mfg. Co., Chicago. Later he organized the firm of Zimmers & Co., manufacturers and sellers agents for different lines of castings, machinery and equipment.

Additional sales of Greaves-Etchells electric furnaces have been announced by the Electric Furnace Construction Co., Philadelphia, as follows: A second six-ton furnace for the American Radiator Co., Buffalo; one 1-ton furnace for the Stoddard Union Co., Lockport, N. Y.; one special furnace for ferroalloys to the Primos Chemical Co., Primos, Pa., and one two-ton furnace to T. Waddell & Sons, New Zealand.

Malleable Foundry Nears Completion

A new malleable iron foundry to have an annual capacity of 6000 tons of castings yearly is being built by the Minneapolis Malleable Foundry Co., Minneapolis. A part of the plant has been completed and the installation of equipment commenced. The company plans to start operations in a limited way about Dec. 1, pending the completion of the entire plant. Contracts have been made covering a large part of its capacity. It is planned to specialize in light malleable castings; power squeezers have been installed and all melting and annealing will be done with fuel oil. The company is a Minnesota corporation organized with a capital stock of $100,000. F. C. Hughes is president and E. H. Williams is secretary and treasurer.

Changes in Shepard Organization

William A. Battey, who for many years has been connected with the Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., as eastern sales manager and sales director, severed his active connection with the business on Dec. 1. He retains his interest in the company and will continue as a director. Mr. Battey, who is vice president of the Pennsylvania Crusher Co., finds it necessary to devote his entire attention to its rapidly expanding business in the manufacture of pulverizers, breakers and special crushing machinery for the by-product coke and other industries requiring reduction apparatus.

W. C. Briggs, who for the past 10 years has been associated with Mr. Battey in the Shepard company's New York office as sales engineer, has been appointed district manager. On Nov. 1, Robert T. Turner joined the New York organization as sales engineer.

The McLain-Carter Furnace Co., Goldsmith building, Milwaukee, will install another 5-ton open-hearth furnace in the plant of the American Machine & Mfg. Co., Atlanta, Ga.

Elmer P. Morris, 126 Liberty street, New York City, manufacturer of iron and brass castings, would like to receive copies of catalogs of foundry equipment, supplies and accessories, together with prices and discounts for export. The catalogs of Mr. Morris were destroyed recently by a fire in his office.

THE FOUNDRY

A monthly journal devoted to all branches of the foundry trade

Published by

The Penton Publishing Co.

Penton Building, CLEVELAND

BRANCH OFFICES

BIRMINGHAM, ENG.....Prince's Chambers
CHICAGO.....1521 Lytton Bldg.
CINCINNATI.....128 Opera Place
NEW YORK.....508 West Street Bldg.
PHILADELPHIA.....1316 Land Title Bldg.
PITTSBURGH.....2148-49 Oliver Bldg.
WASHINGTON, D. C.....708 Metropolitan Bank Bldg.

SUBSCRIPTION

United States and Mexico.....$1.00 a year
Canada.....$1.50 a year
Great Britain and other Foreign Countries Eight Shillings
Single Copies.....15 cents

Copies published three months or more previous to date of current issue, 25 cents each.

ADVERTISING

All communications relating to advertising copy, discontinuances, etc., must be received on the 10th of the month preceding date of publication.

ENTERED AT THE POST OFFICE AT CLEVELAND AS SECOND CLASS MATTER

Copyright 1917, *by the Penton Publishing Co.*

Contents

PAGE

AGREED PRICES AND THEIR MEANING TO FOUNDRYMEN..... 511
FURNACE FOR MELTING COPPER—ZINC ALLOYS..... 514
ORGANIZING A MALLEABLE IRON FOUNDRY IN 90 DAYS..... 515
EMPLOYMENT OF FEMALE LABOR IN THE FOUNDRY..... 519
HOW THE SALES ENGINEER VIEWS THE FOUNDRY..... 520
A TROUBLESOME GATING PROBLEM..... 521
HOW TO SOLVE A FOUNDRY LIGHTING PROBLEM..... 522
LABOR APPRECIATES THE HUMAN ELEMENT..... 524
BOILERS RECLAIM MELTING FURNACE HEAT..... 525
PREPARING SAND FOR STEEL FOUNDRY WORK..... 526
CINCINNATI FOUNDRY FOR MAKING SPECIAL CASTINGS..... 527
MELTING CAST IRON IN CRUCIBLES..... 530
RECENTLY DEVELOPED USES OF ALUMINUM IN INDUSTRY..... 531
INSPECTION OF BRASS AND BRONZE..... 532
ALUMINUM SOLDERS AND FLUX..... 533
BRONZE SUBSTITUTE FOR MALLEABLE IRON..... 533
SHRINKAGE OF ALUMINUM MATCHPLATES..... 533
ALUMINUM FOR COOKING UTENSILS..... 534
BRAZING METAL..... 534
BRASS ALLOYS FOR PISTON RINGS..... 534
VENTING CORES FOR BRASS WORK..... 534
CYLINDER CAPS WHICH CRACK..... 534
SOLVING FOUNDRY TRANSPORTATION AND CONVEYING PROBLEMS..... 535
MALLEABLE FOUNDRY NEARS COMPLETION..... 545
DEATH OF FRANK H. ZIMMERS..... 545
NEW MALLEABLE FOUNDRY IS SOON TO BE OPERATED..... 545
PERSONAL..... 545
CHANGES IN SHEPARD ORGANIZATION..... 545
MOLDING MACHINE—A WAR IMPLEMENT..... 546
ABSORBS ELKHART PLANT..... 547
BOOK REVIEW..... 547
CLAMP FOR LOCKING FLASKS..... 547
COMMERCIAL LABORATORY ESTABLISHED AT BUFFALO..... 547
DEVELOPS NEW FLASK CLAMP..... 547
WOULD ELIMINATE FLOUR IN CORES..... 547
HOW SLUSH CASTINGS ARE MADE..... 548
COAL LOADER FOR STORAGE PILES..... 548
CAN'T SPLINTER NEW LENS..... 548
WHAT THE FOUNDRIES ARE DOING..... 549
INDEX TO THE FOUNDRY FOR 1916..... 550

Molding Machine—A War Implement

MAINTAINING the casting plants of the country at their maximum operating capacity will be an increasingly difficult task, particularly when the second and third drafts further deplete the ranks of labor. The output of these shops must not be curtailed, yet their efficiency will be greatly impaired by the waning man-power and since all kinds of castings in large tonnages will be required for our army and navy for the duration of the war, something must be done at least to insure normal output. At the recent annual meeting of the National Founders' association it was stated that the available labor supply has declined fully 25 per cent and it was pointed out that there will be a further shrinkage as the war progresses. Furthermore, it was estimated that the jobbing shops of the United States are producing only at the rate of 50 per cent of their capacity and to raise their output to a basis commensurate with our present needs, it was stated that their practice must be improved, particularly by the installation of molding machines. Nor are the jobbing shops the only foundries whose methods of operation must be elevated to a wartime standard. Many engaged in other lines of work that may be characterized as semispecialties, also are remiss and a note of warning was sounded that there will be a shortage of castings unless mechanical appliances are adopted immediately to replace hand labor, so far as possible. The molding machine was given the place of honor among foundry mechanical devices that effect the greatest increase in output accompanied by a reduced labor expense, and their immediate widespread application and use not only was recommended, but urged. One of the most interesting and instructive features of this great gathering of foundrymen was a series of moving pictures that showed what is being done with molding machines in some of the large plants. On the various individual patterns, the increase in output, as compared with hand labor, was tremendous and the work illustrated proved the marvelous adaptability of these mechanical devices. It can safely be said that there is a molding machine for every class of work and the jobbing foundryman should have his shop as well equipped as any specialty plant. The employment of women for making cores is receiving more consideration and men engaged in such work, particularly if the cores are light, can be relieved by the employment of female labor. The greatest success, however, has been attained by the isolation of the departments in which the women are employed. Their working hours are different than those of the men engaged in the plant, so that they do not come in contact with them in going to or returning from work. Their surroundings should be congenial and they should be away from the smoke and grime of the shop.

Furnace for Melting Copper-Zinc Alloys

(*Continued from page* 514)

tion, or at least the current must be kept on to keep molten the metal in the secondary loop. It is not possible to change from one mixture to another, except that such change be possible as based on the composition of the metal remaining in the furnace. Experiments conducted by the company tend to prove that there is no great difference in resistance of the molten alloys ranging in composition from 95-5 to 60-40, so that it is possible to successfully melt alloys within this range in the furnace.

Electric Crucible Furnace

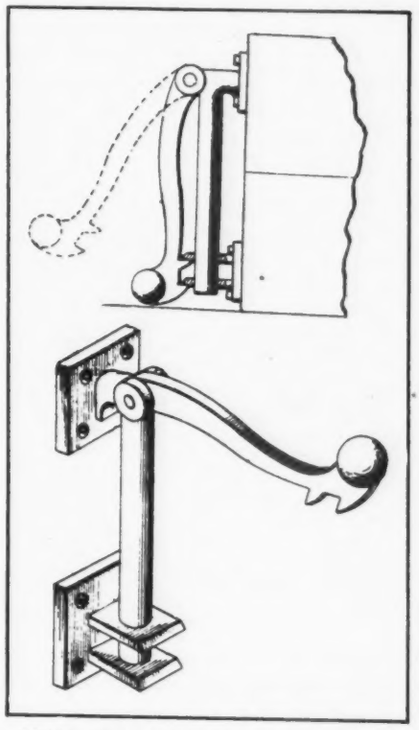
The company also is developing the Ajax-Northrup electric furnace. This furnace is of the induction type, but has no iron cores, as the induction is produced in conjunction with the crucible. It is possible to melt either conducting or nonconducting materials. The furnace operates on two-phase current with balanced loads on the two phases. Satisfactory results have been obtained by using plumbago crucibles as the heat is generated mostly in the metals and the crucible is at no time at a higher temperature than the metal contained in it. Since the crucible is not subjected to oxidizing influences, it is said to last long in service. This furnace may be used with or without crucibles, needs no liquid charge for starting, requires but a small amount of refractory material and is adapted for either intermittent or continuous operation. Tests have demonstrated that with a current consumption of 16 kilowatt hours, 45 pounds of brass scrap can be melted in 35 minutes. Temperatures of approximately 3000 degrees Fahr. have been attained.

Would Eliminate Flour in Cores

Foundrymen throughout the country are being urged by the United States food administration, headed by Herbert C. Hoover, to curtail or eliminate the use of flour for pasting cores, etc. It is pointed out that thousands of barrels of low-grade flour are used for this purpose every year in American foundries. Under normal conditions, this consumption is of no consequence to the food situation since the flour is not of a character ordinarily used in this country for food purposes. At present, however, this flour can be advantageously employed both here and abroad. At the same time it is pointed out that numerous prepared substitutes are available for foundry use some of which are much more efficient than flour. Foundrymen are urged to use these substitutes in place of flour. It is understood the food administration is seriously considering taking action which will prohibit the use of flour in any industry in this country.

Clamp for Locking Flasks

Castings are often spoiled because the flasks in which they are made become shifted due to loose pins or loose clamping. Run-outs, the results of inadequate clamping, or bumps or knocks administered to the mold, are likewise exceedingly troublesome. In order to eliminate these difficulties a



CLAMP DESIGNED TO INSURE TIGHT LOCKING

pin and plate, cast in a single unit to prevent its working loose, were recently invented by John Sonnenfeld, superintendent, Lima Steel Castings Co., Lima, O. The lever attached to the pin is said to act as a clamp. The lever drops by gravity, as indicated in the accompanying illustration, to a vertical position and locks with the two feet cast in the plate.

Absorbs Elkhart Plant

The Davis-Bournonville Co., with general offices and factory at Jersey City, N. J., has taken over the plant and factory of the Davis Acetylene Co., Elkhart, Ind. The Davis Acetylene Co. has been dissolved and the manufacture of acetylene lighting generators and accessories discontinued. The plant hereafter will be operated under management from Jersey City for the manufacture of acetylene pressure generators for the oxy-acetylene process, and for special products. The Canadian factory at Niagara Falls, Ont., which had been jointly occupied by the two companies, has also been taken over, and will be operated exclusively for the manufacture of oxy-acetylene apparatus for the Canadian trade. The Davis-Bournonville Co. has also purchased the H. G. Kotten Co. factory and grounds opposite its Jersey City property. The Kotten factory will be used for manufacturing electrolytic oxygen apparatus and accessories, releasing considerable space in the company's new factory building for increased output of oxy-acetylene welding and cutting apparatus. A four-story warehouse, 60 x 100 feet, of brick and mill construction, will be immediately erected on the Kotten property, still leaving ground for a five-story factory, 60 x 150 feet, corresponding to the company's No. 3 factory, recently completed, which may be erected the coming year.

Book Review

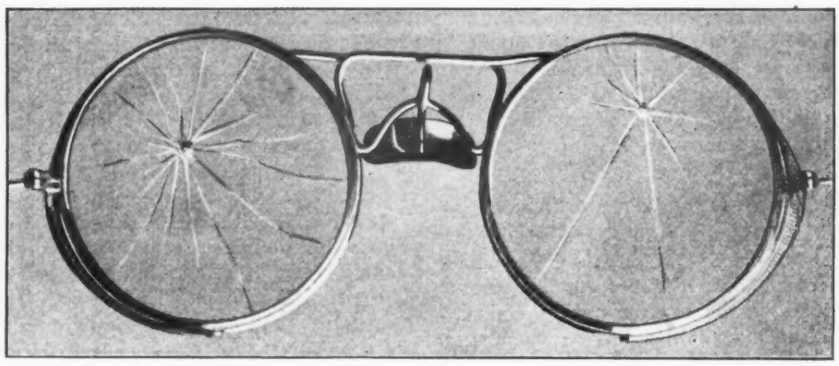
Hendricks Commercial Register for Buyers and Sellers, issued by S. E. Hendricks Co., Inc.; cloth; 2209 pages, 7½ x 9 inches; published by the S. E. Hendricks Co., Inc., and furnished by THE FOUNDRY for $10 net.

The twenty-sixth annual edition of Hendricks' Commercial Register of the United States has just been issued. The book has been revised, corrected and brought up to date. It is especially devoted to the interests of the architectural, contracting, electrical, engineering, hardware, iron, mechanical, mill, mining, quarrying, railroad, steel and kindred industries. Full lists are included of producers, manufacturers, dealers and consumers. All products, from the raw material to the finished article also are listed.

The text covers 2209 pages, the index to trade classifications alone extending over 151 pages, and includes over 50,000 trade references. The list of trade names, brands, titles of identification, etc., numbering 1212 pages, furnishes ready reference to distinctive products manufactured by concerns listed in the work. An alphabetical section, containing in one list the name, trade description and address of every concern appearing in the book, is published for the first time in this edition.

Commercial Laboratory Established at Buffalo

The Courtney-Fraser Co., Inc., Buffalo, has established a chemical laboratory at 529 Main street, which is modernly equipped throughout with apparatus for making analyses and tests of all kinds of foundry and steel works



WORKMAN'S GOGGLE EQUIPPED WITH NON-SPLINTERING LENSES

materials, castings, iron and steel products, etc. The offices of the company and the staff of assistants have had a wide experience, not only in laboratory work, but also in foundry practice.

Coal Loader for Ground Storage Piles

The problem of finding a convenient method of loading coal from ground storage, gave impetus to the invention of a wagon loader, which is now finding general application. The accompanying illustration shows a wagon loader manufactured by the Link-Belt Co., Chicago, loading coal into a motor truck at the plant of the American Optical Co., Southbridge, Mass.

The bituminous coal arrives in railroad cars and is dumped from the trestle to the ground storage pile. The power house is situated some distance from the storage pile which necessitates the use of a motor truck for rapid transportation. It is said that the wagon loader fills the truck in approximately five minutes. It is driven by an electric motor and requires one man for operation.

How Slush Castings Are Made

When a metal or carbon mold is filled with a low melting metal or alloy and the latter, after standing a brief interval is poured out of the mold again, a shell is left in the mold that takes the form of the latter and constitutes a hollow casting possessing a better proportioned wall thickness than it is possible to get with cores. Such castings usually take the form of more or less artistic articles, such as statuettes for clocks, lamp bases, etc. The metal is generally zinc and metal parts made in this way are known as *slush* castings. It has been found that the purer the zinc used, the better the castings and the less trouble experienced from cracking. It is common practice to add a small amount of aluminum to the zinc for making slush castings as it clears the surface of the metal and makes it run better. About 0.10 per cent or even less of aluminum is used, but it is a curious fact that while 2 or 3 per cent of aluminum will cause the zinc to become stiff and slushy, with 5 per cent aluminum the zinc pours well and produces good castings. Since aluminum increases the cost of the zinc, it is most generally used as a deoxidizer for making slush castings, and not for producing an alloy, and the amount added is less than 0.10 per cent. Some manufacturers have found that the addition of not to exceed 0.005 per cent of aluminum increases the fluidity of the zinc and permits slush castings to be made that are free from cold shuts and cracks. This small amount of aluminum is most conveniently added in the form of a mixing alloy of zinc and aluminum.

Can't Splinter New Lens

A new goggle with lenses that are said not to scatter particles even though badly broken, has been developed by the Strong, Kennard & Nutt Co., Cleveland. By a patented process two pieces of optical glass, with a sheet of transparent celluloid between them, are fused together without cement. The lens, it is said, has 97.64 per cent transparency.

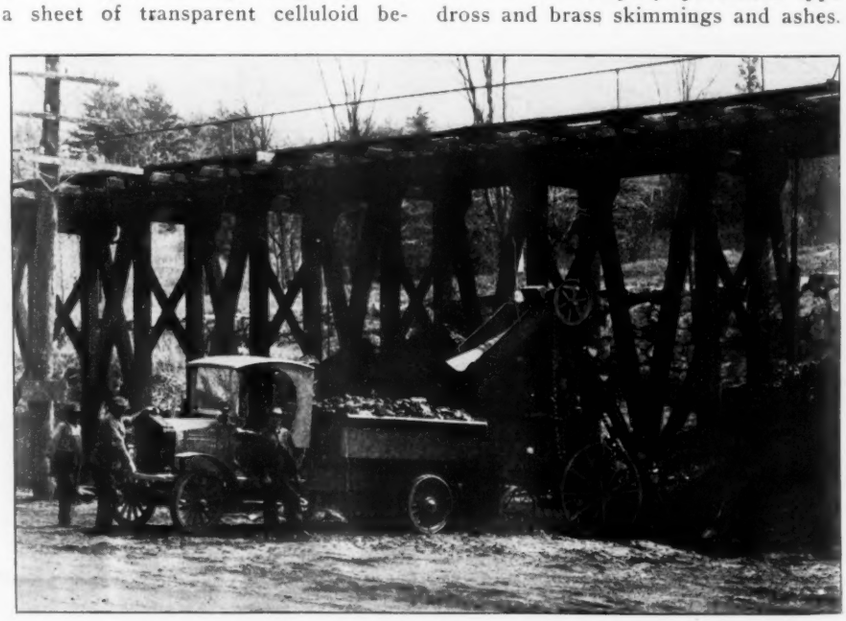
It is claimed that this lens has unusual strength in that it is not easily penetrated, and even when penetrated the particles hold together, thus removing one drawback to the wearing of goggles. The two pieces of glass and the piece of celluloid composing each lens are fused together after the glass is cut to size and shape, as it is impossible to work the process in the reverse order. The peculiarity of the manufacture prevents sweating.

The Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., manufacturer of conveying and elevating machinery, has established an export department at 30 Church street, New York.

The Pangborn Corp., Hagerstown, Md., has purchased the sand blast department of the Curtis Pneumatic Machinery Co., St. Louis. A complete line of machines will be carried in stock including repair parts.

The Whiting Foundry Equipment Co., Harvey, Ill., now is directly represented in Pittsburgh and vicinity by F. J. Page, located at 411 Fulton building. Mr. Page has been in the employ of the Whiting Foundry Equipment Co. for many years in both the estimating and sales departments.

H. Kramer & Co., Chicago, metal refiners, smelters and dealers, now are located in their new foundry and warehouse built on a 1-acre site at 1324 to 1344 West Twenty-first Place. Shipping facilities are provided by a side tract connecting directly with Chicago, Burlington & Quincy railroad. This company purchases type dross and brass skimmings and ashes.



MACHINE LOADING COAL ON 3½-TON TRUCK FROM GROUND STORAGE PILE

WHAT THE FOUNDRIES ARE DOING

Activities of the Iron, Steel and Brass Shops

The Skinner & Eddy Corp., Seattle, will build a foundry, 60 x 150 feet.

The Novo Engine Co., Lansing, Mich., will build a foundry and machine shop.

The Westinghouse Electric & Mfg. Co., East Pittsburgh, will build a $50,000 foundry.

Wickes Bros., Saginaw, Mich., contemplates the addition of a foundry to their plant.

A contract has been let for the erection of a 70 x 85-foot addition to the plant of the Fairmount Foundry Co., Woonsocket, R. I.

The Liberty Foundries Co., Rockford, Ill., has increased its capital stock from $5000 to $25,000.

The Boston Stove Foundry Co., Boston, has been incorporated by Louis Cohen, Joseph Lanes and Isaac Bachrach with $50,000 capital.

The United States Malleable Iron Co., Toledo, O., has increased its capital stock from $250,000 to $350,000.

Walloch Foote and Oscar Berg have organized the Advance Brass Mfg. Co., Muskegon, Mich., and will make brass castings.

The Ben Sibbett Iron & Foundry Co., Wichita, Kans., has been incorporated with a capital stock of $30,000.

A contract has been awarded by the Interstate Foundry Co., Cleveland, for the erection of a $20,000 addition.

The Cooley Mfg. Co., Seattle, Wash., contemplates building a brass foundry and other additions to its plant.

The Barton Tannery Co., 310 Hunter street, Newark, N. J., will build a steel foundry, 39 x 100 feet, at a cost of $20,000.

The Otto Biefeld Co., Watertown, Wis., will build a foundry and machine shop addition at a cost of approximately $35,000.

The Moreland Motor Truck Co., 1701 North Main street, Los Angeles, is erecting an electric steel foundry, 60 x 120 feet.

S. A. Michler, San Francisco, will erect a two-story foundry and machine shop at a cost of $10,000.

The Sydney Foundry & Machine Co., Sydney, N. S., will build a foundry at Halifax, N. S., at a cost of $7500.

A contract has been awarded by the Essex Foundry Co., Newark, N. J., for the erection of an addition.

The A. W. Wheaton Brass Works, Newark, N. J., will build a brick, 33 x 50-foot brass foundry at a cost of $4000.

The General Electric Co., Everett, Mass., has let the contract for a 42 x 210-foot addition to its foundry.

The Barlow Foundry Co., Newark, N. J., will erect a foundry of brick and steel construction. The estimated cost is $20,000.

The American Radiator Co., Buffalo, will build a 120 x 200-foot foundry at a cost of $150,000.

A contract has been awarded for the erection of a new plant for the Van Wert Foundry Co., Van Wert, O.

The Atlas Steel Casting Co., 1963 Elmwood avenue, Buffalo, will erect an addition, 40 x 96 feet, at a cost of $4000.

The Waterloo Gasoline Engine Co., Waterloo, Ia., will build a 120 x 525-foot foundry, of brick and concrete construction.

The Grabler Mfg. Co., 6565 Broadway, Cleveland, has awarded the general contract for a 3-story, 47 x 130-foot foundry.

Plans are being prepared for a steel foundry to be erected for the Fulton Steel Corp., Fulton, N. Y., at a cost of $60,000.

The Culinary Mfg. Co., 35 Day street, Orange, N. J., contemplates adding a foundry to its plant.

The Ohio Steel Foundry Co., Lima, O., contemplates the erection of several additions to its plant.

The Zanesville Malleable Co., Zanesville, O., has purchased a three-acre site on which it will build a plant, 50 x 150 feet.

The Master Carburetor Co., Los Angeles, has been incorporated with $200,000 capital, by D. F. Poyer, E. M. Chandler and Charles G. Harness.

The Stewart Mfg. Co., 323 Wells street, Chicago, manufacturer of die castings, has changed its name to the J. K. Stewart Specialty Co.

W. G. Schell has bought the plant of the Uplands Foundry & Machine Co., Uplands, Cal., which he will equip for the manufacture of heaters and distillate burners.

The Lycoming Foundry & Machine Co., Williamsport, Pa., has purchased the plant of the United States Machine Co. in that city, and has remodeled it into a foundry.

James and Waldo Kuffman have organized the Ashland Brass Foundry Co., Ashland, O., and are building a plant for the manufacture of brass and aluminum castings.

Contracts have been awarded by the Meadville Malleable Iron Co., Meadville, Pa., for the erection of a three-story, 35 x 120-foot foundry of reinforced concrete construction.

The St. Louis Malleable Casting Co., St. Louis, will build a steel foundry, a small forging plant and a brass shop on a 3½-acre site which it recently purchased.

R. H. Hassler, Indianapolis, manufacturer of automobile appliances, will build a foundry at 1531 Naomi street. The estimated cost is $17,000.

Bids are being received for a tire mold building to be erected for the Wilson Foundry & Machine Co., Pontiac, Mich. The expenditure will approximate $30,000.

Plans are being prepared for the erection of a large addition to the foundry and machine shop of the Arneson Foundry Co., Kenosha, Wis.

The Chicago Stove & Range Co., 2033 South Clark street, Chicago, will erect a $20,000 foundry at its plant at Benton Harbor, Mich.

The Pusey & Jones Co., Wilmington, Del., will build a $70,000-foundry, a $50,000-pattern storage room and a $10,000-pattern shop addition, making a total expenditure of $130,000.

The Newport News Shipbuilding & Drydock Co., Newport News, Va., contemplates the erection of additions to its foundry, machine shop and other buildings.

Plans have been completed for a 60 x 80-foot foundry to be erected for George Mockley, 3901 Ninth avenue south, Seattle, at a cost of $3000.

The Gunning Boiler & Machine Co., New Bedford, Mass., will build a four-story, 36 x 134-foot addition to its foundry and machine shop.

The J. C. Born Machine & Foundry Co., Belleville, Ill., has been incorporated with $10,000 capital, by John C. Born, William F. Born and E. W. Twenhoefel.

The Southern Equipment Co., Memphis, Tenn., has been incorporated with $25,000 capital to engage in the foundry business. The incorporators are R. H. McWilliams, N. M. Dickson, A. W. Fisher Jr. and D. B. Sweeney.

The Oxford Foundry & Machine Co., Oxford, N. J., has been incorporated to engage in the manufacture of machinery with $50,000 capital. The incorporators are William A. Bartley, Howard L. Coas and Bernard Brady.

The John Davenport Co., Stamford, Conn., has sold its foundry to A. B. Venesch & Co., bankers, New York, who will conduct the business. Improvements costing $500,000 will be made.

The industrial committee of the Veedersburg commercial club will build a stove plant which will include a foundry, one story, 50 x 91 feet; a cleaning room, 30 x 31 feet; a machine shop and an office.

The Thompson Heater Corp., Buffalo, contemplates the erection of a new gray iron foundry with a daily capacity of 10 to 15 tons. The equipment has not yet been purchased.

The Astoria Marine Iron Works, Astoria, Oreg., is considering a site on which it proposes to build a large machine shop and a foundry for the manufacture of marine equipment.

The Mueller Mfg. Co., Decatur, Ill., will build a branch plant at Port Huron, Mich., which will include a brass foundry, 86 x 140 feet; a rod mill, 80 x 100 feet, and a power house. The cost will approximate $400,000.

The Ecorse Foundry & Machine Co., Ecorse, Mich., which recently completed a foundry for the manufacture of motor car and tractor wheel castings, is building additions which will increase its capacity from 60 to about 100 tons per day.

The R. W. G. Foundry Co., Anderson, Ind., recently has placed a foundry in operation for the manufacture of gray iron castings. The officers of this company follow: J. E. Westerfield, president; M. G. Reynolds, vice president and J. C. Groble, secretary and treasurer.

A contract has been let by the Blake & Knowles Works of the Worthington Pump & Machinery Corp., Cambridge, Mass., for the erection of a foundry addition, one-story, 80 x 120 feet, and a brick and concrete building, four stories, 65 x 120 feet.

Albert W. Wagner, Thomas W. Samuels and Charles C. Leforgee have organized the Wagner Castings Co., Decatur, Ill., with $40,000 capital, and have taken over the business of the Decatur Foundry Co. The new company will continue the manufacture of light gray iron castiags and later also will make malleable castings.

Index to Volume XLV

January---December, 1917

A

Abell-Howe Co. 398
Abrasive Wheel Manufacturers, Grinding Wheel Standards. ....Data Sheets Nos. 227 and 228, Feb.
Accidents, Grinding Wheel, Table of Causes of. ....Data Sheets Nos. 225 and 226, Jan.
Accidents, Preventing, in Industrial Yards 461
Acid, Acetic, Bronze Mixture to Resist.. 236
Acid and Basic Electric Steel, Castings from 220, 269
Advantages of Hand and Power Machine Molding 285
Aeroplane Metal 30
Aeroplane Motor Castings, Mixture for... 116
Air Compressor for Foundry Use..... 168
Ajax Metal....Data Sheet No. 246, Nov.
Ajax Metal Co., Furnace for Melting Copper-Zinc Alloys 514
Ajax Plastic Bronze. .....Data Sheet No. 245, November
All Iron is Good Iron..... 14
Alloy, 80-10-10, Properties of the.....272, 311
Alloy, 88-10-2 271
Alloy, Electric Resistance..... 301
Alloy Information, Bureau of Standards Asks 205
Alloy, Non-Shrinkable Pattern..... 447
Alloy, White Aluminum..... 196
Alloy, White Brass..... 72
Alloy, White Metal Pattern..... 285
Alloy, White Nickel, Very Stiff..... .....Data Sheet No. 237, July
Alloy, Zinc, for Match-Plates..... 31
Alloys, Aluminum ....Data Sheets Nos. 235 and 236, June
Alloys, Aluminum ....Data Sheets Nos. 241 and 242, Sept.
Alloys, Aluminum, Nomenclature of..... 285
Alloys and Metals, Sand-Cast, Results of Tests of 270
Alloys, Copper Zinc, Hardness of..... 155
Alloys, Gas as Fuel for Melting..... 193
Alloys, Names and Composition of Miscellaneous ....Data Sheets Nos. 247 and 248, December
Alloys, Proprietary Bearing. ....Data Sheets Nos. 245 and 246, Nov.
Alloys Similar to Duraluminum, Mixtures of 284
Alloys, Strong Aluminum..... 327
Alumina, Study of Inclusions of, in Steel 197
Aluminum Alloys ....Data Sheets Nos. 235 and 236, June
Aluminum Aloys Data Sheets Nos. 241 and 242, Sept.
Aluminum Alloys, Nomenclature of..... 285
Aluminum Alloys, Strong..... 327
Aluminum-Bronze Castings 157
Aluminum-Bronze Castings, Soldering.... 284
Aluminum Bronze, Soldering. .....Data Sheet No. 244, October
Aluminum Bronze, Ten Per cent..... 273
Aluminum-Bronze Tests and Their Significance 21
Aluminum Bronze, Titanium and..... 505
Aluminum Casting Difficulties..... 496
Aluminum Castings, Making Large Pure.. 98
Aluminum, Copper-Plating 283
Aluminum for Cooking Utensils..... 534
Aluminum Match Plates, Making..... 79
Aluminum Match Plates, Shrinkage of.... 533
Aluminum Mixture for Pistons..... 497
Aluminum, 92 Per Cent and Copper, 8 Per Cent 273
Aluminum Nitride 497
Aluminum, No. 31, Mixture of..... 72
Aluminum, No. 12..... 115
Aluminum Pistons, Mixture for..... 31
Aluminum, Recently Developed Uses of, in Industry 531
Aluminum, Removing, from Brass..... 448
Aluminum Solders and Flux..... 533
Aluminum, White, Alloy..... 196
American Foundry Equipment Co., Develops Large Sand-Blast Barrel..... 124
American Foundry Equipment Co., Sand-Blast Machines 263
American Foundry Equipment Co., New Departure in the Design of Sand Blast Apparatus 168
American Foundry in a Time of War..... 127
American Foundrymen's Association, Boston Prepares for Founders' Week 245
American Foundrymen's Association, Foundrymen Display Keen Interest in Boston Show 290
American Foundrymen's Association, Installing a Uniform Cost System in Foundries 206
American Foundrymen's Association, Ladle Sleeves and Stoppers..... 451
American Foundrymen's Association, Program of 343
American Foundrymen's Association, Spirit of Service Pervades Meeting of..... 411
American Institute of Metals, Boston Prepares for Founders' Week..... 245
American Institute of Metals Prepares a Great Program 311
American Institute of Metals, Program of 343
American Institute of Metals Puts in a Busy Week 424
American Molding Machine Co., New Type of Roll-Over Molding Machine..... 507
American Museum of Safety, Safety Awards Announced 153
American Radiator Co., Removing Traditional Evils of Malleable Practice.....73, 398
American Society for Testing Materials, Annual Meeting of..... 98
American Society for Testing Materials Considers New Specifications..... 270
American Society for Testing Materials Outlines Comprehensive Program..... 243
American Society for Testing Materials, Tentative Specifications for Brass Castings 446
American Steel Foundries, Self-Skimming Ladle for Pouring Steel for Castings.... 244
Analyses for Anti-Friction Metal..... 284
Analyses of Bearing Metals..... 236
Analysis of Benedict Metal..... 72
Anodes, Nickel, Trouble with..... 71
Anodes, Scrap Nickel, Reclaimed by Welding 484
Anti-Acid Bronze 115, 497
Anti-Friction Metal 157
Anti-Friction Metal, Analyses for..... 284
Arch, Roof, for Annealing Ovens..... 509
Army, Uncle Sam's New, Making Cook Stoves for 389
Art Work, Gray Iron, Making..... 85
Art Work, White Metal for..... 196
Artistic Gray Iron Castings Made by Russian Foundrymen 359
Ashes, Brick Made from..... 248
Automobile Motor Castings are Molded, How 469
Automobile, The Foundry Behind the..... 223
Average Output of Cupolas. .....Data Sheet No. 234, May
Avoiding the Cutting of Cores..... 447

B

Babbitt Metal, How to Melt..... 369
Babbitt Metal, Scrap, Utilizing..... 236
Babbitting Thrust Collars, Method of.... 284
Balls, Cast Iron, for Grinding Mills..... 14
Balls, Chilled Cast Iron, How to Make.. 288
Balls, Chilled Iron..... 321
Barlow Foundry Reorganized..... 153
Barnes Foundry & Mfg. Co. To Make Automobile Castings 452
Basic and Acid Electric Steel, Castings from 220, 269
Bauxite, Production of, in 1916..... 305
Bearing Alloys, Proprietary. ....Data Sheets Nos. 245 and 246, Nov.
Bearing Metals, Analyses of..... 236
Bearings, Cheap Car Journal, Mixture for 70
Bearings, Journal, Casting..... 111
Bearings, Rolling Mill..... 116
Belt Slings for Cores..... 102
Bench, Patternmaker's Work, Top for the 246
Benedict Metal, Analysis of..... 72
Benedict Nickel .....Data Sheet No. 238, July
Beryllium 194
Bethlehem Steel Co. Makes Large Iron Mold for Guns..... 188
Bins, Storage, Durable, Design for..... 502
Blackwood Steel Foundry Co., New Converter Plant for Economical Operation 133
Blocks, Wire Drawing..... 71
Board, Patternmakers' Construction..... 369
Boilers Reclaim Melting Furnace Heat... 525
BOOK REVIEWS:
Annual Chemical Directory of the United States 251
Selling Your Services..... 93
The Founder's Manual..... 260
The Principles of Iron Founding..... 489
Booth-Hall Co., Employs Auxiliary Electrode 466
Booth-Hall Co. Will Build Electric Furnaces 273
Boring Mill, Casting Floor Plate and Bed for a..... 491
Boston Prepares for Founders' Week..... 245
Boston Welcomes the Great Army of foundrymen 343
Brass Alloys for Piston Rings..... 534
Brass and Bronze Castings, Inspection of 154
Brass and Bronze, Inspection of..... 532
Brass, Brazing, Difficulties in Making.... 30
Brass Castings, Shrinkage Difficulties in. 71
Brass Castings, Cleaning Solution for..... 30
Brass Castings, Cleaning, with Acid..... 448
Brass Castings, Color of..... 157
Brass Castings, Facings for..... 196
Brass Castings, How to Prevent Pin Holes in 327
Brass Castings, Making Thin Wall Ornamental 13
Brass Castings, Minute Cavities in..... 448
Brass Castings, Porous..... 29
Brass Castings, Tentative Specifications for 446
Brass Castings, Trying to Use Poor Scrap in 30
Brass Cleaner and Deoxidizer..... 114
Brass Concentrates, Metal from..... 497
Brass, Core Sand for..... 326
Brass, Failure of..... 114
Brass Foundry, Plaster of Paris in the... 326
Brass Foundry, What the, Has Done in 25 years 386
Brass Foundrymen, Formulas for the... Data Sheets Nos. 235 and 236, June; 237 and 238, July; 241 and 242, September; 243 and 244, October; 245 and 246, November; 247 and 248, December.
Brass, Melting, in a Gas-Fired Cupola Furnace 189
Brass, Melting, in the Cupola..... 496
Brass Particles, Flux for..... 196
Brass Particles, Small, Flux for..... 157
Brass Plungers, Pitted..... 31
Brass, Progress in Casting, in Permanent Molds 70
Brass, Red, Mixtures, Cheap..... 285
Brass, Refining the Grain of..... 156
Brass, Removing Aluminum from..... 448
Brass Scrap, Thin, Rolled, Utilizing..... 236
Brass, Suggestions for Melting..... 495
Brass, White, Alloy..... 72
Brass, White, for Automobile Door Handles 236
Brass, Yellow, Castings, Rough and Dirty 448
Brass, Yellow, Mixing and Melting..... 116
Brazing Brass, Difficulties in Making..... 30
Brick Made from Ashes..... 248
Brick, Refractory, Slag Test for, in Steel Industry 340
Bridging, Cupola, Preventing..... 310
Bridging, Slow Melting and..... 97
Briquettes Fuel Oil, How are Used..... 289
Bright, Smooth Surface on Castings..... 79
British Foundrymen's Association Annual Report 306
British Foundrymen's Association, Abstracts from Papers Read at..... 302
British Foundrymen's Association, Increased Use of Molding Machines in English Foundries 37
British Foundrymen's Association Plans Program for 1917-1198..... 509
British Institute of Metals Meets..... 132
British Institute of Metals, Summary of Papers Presented at..... 189
Bronze, Ajax Plastic. .....Data Sheet No. 245 November
Bronze, Aluminum, Castings..... 157
Bronze, Aluminum, Castings, Soldering... 284
Bronze, Aluminum, Soldering. .....Data Sheet No. 244, October
Bronze, Aluminum, Ten Per cent..... 273
Bronze, Aluminum, Tests and Their Significance 21
Bronze and Brass Castings, Inspection of 154
Bronze and Brass Sticks, Porous..... 31
Bronze, Anti-Acid 115, 497
Bronze Bushings, Difficulties in Casting... 236
Bronze, Carbon, Cornish and Damascus.. .....Data Sheet No. 246, November
Bronze Casting Molding Job, Difficult.... 234
Bronze, Manganese, How to Mix and Melt 72
Bronze, Manganese, Introducing Iron Into 71
Bronze, Manganese, Properties of..... 272
Bronze, Manganese Unusually Strong.... 31
Bronze Mixture, Difficult, to Cast..... 115
Bronze Mixture to Resist Acetic Acid.... 236
Bronze Parts, Mixture for..... 13
Bronze, Statuary, Open-Flame Furnace for Melting 246
Bronze, Titanium and Aluminum..... 505
Bronze to Resist Mine Water..... 497
Bronze, Tobin 115
Bronze, Tobin, Mixture..... 157
Bronze, Vanadium, Making..... 497
Bronze, Vanadium, Submarine Castings... 121
Bronze, Wax-Finishing 156
Bronzes, Properties of, for Mechanical Purposes 68
Buick Motor Co., The Foundry Behind the Automobile 223
Bureau of Standards Asks Alloy Information 205

Bureau of Standards Recommends Standard Screen Scale for Sieves..... 163
Bushings and Gear Blanks, Remedying Brittle 327
Bushings, Bronze, Difficulties in Casting.. 236

C

Calcium and Its Uses..... 260
Calculating Tensile from Transverse Strength 445
Can Government Metal be Forged?..... 448
Canadian Pacific Railway Co., Casting Chilled Car Wheels in a Canadian Foundry 297
Car Wheels, Chilled, Casting in a Canadian Foundry 297
Car Wheels, Mine, Chilling..... 315
Carbon Bronze..Data Sheet No. 246, Nov.
Carbon, Combined, To Reduce..... 47
Care to be Exercised in Vibrator Operation 249
Carmelia Metal..Data Sheet No. 246, Nov.
Cast Iron Balls, Chilled, How to Make... 288
Cast Iron Balls for Grinding Mills..... 14
Cast Iron, Losses in Melting..... 222
Cast Iron, Malleable, Shrinkage of..... 19
Cast Iron Molds and Cores, Use of..... 164
Cast Iron Shells, Making, in Permanent Molds 439
Cast Iron Work, Control of Cooling Metal in 302
Cast Metal, Influence of Occluded Gases in 149
Casting Brass in Permanent Molds, Progress in 70
Casting, Bronze, Molding Job, Difficult... 234
Casting Chilled Car Wheels in a Canadian Foundry 297
Casting Difficulties, Aluminum..... 496
Casting Difficulty, Brass, Due to Insufficient Feeding 30
Casting Floor Plate and Bed for a Boring Mill 491
Casting, Gear Cover, Quick Method of Making a 146
Casting Iron Around a Rigid Center..... 20
Casting, Large, Repairing a, by Electric Arc Welding 120
Casting, Large, Varying Strength in Different Parts of a 305
Casting Malleable Iron in Permanent Molds 40
Casting Nonferrous Metals, Chill Molds for 28
Casting Plant, Steel, Electric Furnace in the 232
Castingr Poduction in 1916..... 164
Casting, Propeller, is Essential to Our Defense 366
Casting, Steel, Specifications, Navy Revises 318
Casting Steel Wheels for Motor Trucks... 61
Castings, Aeroplane Motor, Mixture for... 116
Castings, Aluminum-Bronze 157
Castings, Aluinum-Bronze, Soldering..... 284
Castings, Artistic Gray Iron, Made by Russian Foundrymen 359
Castings, Automobile Motor, Are Molded, How 469
Castings, Brass, Cleaning Solution for.... 30
Castings, Brass, Cleaning, with Acid..... 448
Castings, Brass, Color of..... 157
Castings, Brass Facings for..... 196
Castings, Brass, How to Prevent Pin Holes in 327
Castings, Brass, Making Thin Wall Ornamental 13
Castings, Brass, Minute Cavities in..... 448
Castings, Brass, Porous..... 29
Castings, Brass, Tentative Specifications for 446
Castings, Brass, Trying to Use Poor Scrap in 30
Castings, Bright, Smooth Surface on..... 79
Castings, Bronze and Brass, Inspection of 154
Castings, Chilled, from a Cupola Running Gray Iron 188
Castings, Copper, Deoxidizer for..... 72
Castings, Copper, Porous..... 195
Castings, Early Artisans' Masterpiece, Remarkable Gray Iron Reproductions of ..... Supplement, October
Castings, Early Use of Permanent Molds for 274
Castings for Pianos, Making..... 285
Castings from Acid and Basic Electric Steel 220, 269
Castings, Gray Iron, Effects of Seasoning on 435
Castings, Gray Iron, Unique..... .....Supplement, November
Castings, How to Eliminate Sulphur Holes in 119
Castings, Large Pure Aluminum, Making. 98
Castings, Magnalium 196
Castings, Malleable Iron, Producing Machinable 449
Castings, Malleable, Modern Method of Gating 319
Castings, Manganese Steel, Manufacture of 141
Castings, Motor Car, How Cores for, Are Made 255
Castings, Nonferrous, Making, in a Railroad Shop 1
Castings, Oxy - acetylene Torch, Mixture for 327
Castings, Railroad Malleable, Tentative Specifications for 295
Castings, Rough and Dirty Yellow Brass 448
Castings, Seasoning of 96
Castings, Semisteel 248
Castings, Semisteel, Properties of..... 53
Castings, Sound, Use of Chills in Producing 302
Castings, Steel, Cores for..... 246
Castings, Steel, Effect of Copper on Shrinkage of 165
Castings, Steel, for Ordnance Construction 453, 477
Castings, Steel, Heading, Gating and Chilling 304
Castings, Steel, How to Use Titanium in Making 15
Castings, Steel, Output of..... 254
Castings, Steel, Progress in the Manufacture of 328
Castings, Steel, Repairing Cracks in, Electrically 306
Castings, Stove, Mixture for..... 452
Castings, Strong 165
Castings Subjected to Hydrostatic Test... 283
Castings Subjected to Water Pressure.... 327
Castings, Vanadium Bronze Submarine... 121
Castings with a White Core..... 130
Cause of Flaking..... 447
Chains, Strength of..... .....Data Sheet No. 239, August
Charging, Cupola 93
Cheap Mixture for Locks..... 157
Cheap Red Brass Mixtures..... 285
Chemical Elements, Melting Points of the .....Data Sheet No. 233, May
Chicago Foundrymen's Club Elects Officers 82
Chill Cracks in Lathe Beds..... 182
Chill Molds for Casting Nonferrous metals 28
Chilled Castings from a Cupola Running Gray Iron 188
Chilled Iron Balls..... 321
Chilling Mine Car Wheels..... 315
Chilling Steel Castings, Heading, Gating and 304
Chills, Use of, in Malleable Iron Practice 303
Chills, Use of, in Producing Sound Castings 302
Cleaning Brass Castings with Acid..... 448
Cleaning Solution for Brass Castings..... 30
Cleveland Co-Operative Stove Co., New Cleveland Stove Foundry for Maximum Output 307
Cleveland Salt Works, Demonstrating the Reliability of Motor Drive..... 40
Coal, Bituminous, Melting in a Cupola with 67
Coal, Powdered, as a Fuel in Malleable Shops—IV 32
Coal, Pulverized, for Melting Malleable Iron 487
Coal Screenings, Melting with..... 156
Coatings, Protective: Japans and Enamels —II 138
Coatings, Protective: Lacquers—I 103
Coke Bed, Determining Proper Weight of 132
Collars, Thrust, Method of Babbitting.... 284
Color of Brass Castings..... 157
Colorado Fuel & Iron Co., Large Scrap Melting Cupola 462
Concentrates, Brass, Metal from..... 497
Connections, Sizes of, for Wood-Working Machinery.....Data Sheet No. 230, March
Conserve Our Metal Resources, How We May 209
Constructing a Simple Pattern..... 13
Construction Board, Patternmaker's..... 369
Contraction, Shrinkage and..... 5
Control of Cooling Metal in Cast Iron Work 302
Converter Plant, New, for Economical Operation 133
Conveying and Transportation Problems, Foundry, Solving 535
Conveyors, Gravity, for Foundry Materials 508
Cooper, H. W., Saddlery Hardware Mfg. Co., Hand Squeezers..... 507
Copper Castings, Deoxidizer for..... 72
Copper Castings, Porous 195
Copper, Effect of, on Shrinkage of Steel Castings 165
Copper, Experiments with Sulphur in.... 447
Copper, Melting, in Cupola..... 195
Copper-Melting Medium, Electric Furnace as a 280
Copper, Phosphor, and Phosphor-Tin, Effects of 71
Copper-Plating Aluminum 283
Copper, Selenium in..... 369
Copper Turnings, Utilizing..... 283
Copper, Welding 115
Copper Zinc Alloys, Hardness of..... 155
Core Buster, New..... 249
Core Compound Manufacturers Beware!.. 294
Core Oven, Improved..... 408
Core Reducer 293
Core Sand for Brass..... 326
Core Sand Mixture for Globe Valves..... 447
Core, White, Castings with a..... 130
Cores, Avoiding the Cutting of..... 447
Cores, Belt Slings for..... 102
Cores, Cast Iron Molds and, Use of..... 164
Cores for Motor Car Castings, How, Are Made 255
Cores for Steel Castings..... 246
Cores, Radiator, Economical..... 462
Cores, Venting, for Brass Work..... 534
Coring and Molding a 5-Ton Gear Cutter Bed 363
Cornish Bronze ....Data Sheet No. 246, November
Cost Accounting, Foundry, Essential Factors in 90
Cost of Patterns, Influence of Design on the 33, 301
Cost of the Cupola Heat, Figuring the.. 102
Cost System for a Small Malleable Foundry 9
Cost System in Foundries, Uniform, Installing a 206
Costs, Ingot Mold, How Walker Process Reduces 158
Counting Machine, Screw..... 124
Cracks, Chill, in Lathe Beds..... 182
Craftwork in the Foundry..... ..... Supplement, October
Crucible, Test of..... 206
Crucibles, Electric Heating of..... 194
Crucibles, How the War Affects Manufacture of 494
Crucibles, Melting Cast Iron in..... 530
Crucibles, Safe Handling of, in the Foundry 316
Crude-Oil Furnace, Melting in a..... 194
Cubic Feet of Air Handled Through Average Dust-Collecting Hoods..... .....Data Sheet No. 229, March
Cupola Bridging, Preventing..... 310
Cupola Charging 93
Cupola Doors, Counter-Balanced 465
Cupola Flux, Limestone for..... 118
Cupola Fuel, Oil Residue as a..... 205
Cupola Furnace, Gas-Fired, Melting Brass in 189
Cupola Heat, Figuring the Cost of the... 102
Cupola, Large Scrap Melting..... 462
Cupola, Melting Brass in the..... 496
Cupola, Melting Copper in..... 195
Cupola, Melting in a, with Bituminous Coal 67
Cupola Running Gray Iron, Chilled Castings from a..... 188
Cupola, Small, to Increase the Melting Capacity of a..... 291
Cupolas, Average Output of..... .....Data Sheet No. 234, May
Cylinder Caps Which Crack..... 534
Cylinders, Mixture for..... 202

D

Damascus Bronze ....Data Sheet No. 246, November
Davis, James C., Self-Skimming Ladle for Pouring Steel for Castings..... 244
Davis-Bournonville Co., Welding Institute Established 387
Demonstrating the Reliability of Motor Drive 40
Deoxidizer, Brass Cleaner and..... 114
Deoxidizer for Copper Castings..... 72
Deoxidizing and Refining Process, Schwartz. 294
Design for Durable Storage Bins..... 502
Design, Influence of, on the Cost of Patterns 33, 301
Design, Pattern, from the Foundrymen's Viewpoint 37
Designing a Modern Foundry of Moderate Size 43
Determining Proper Weight of the Coke Bed 132
Detrick, M. H., Co., Roof Arch for Annealing Oven 509
Die-Casting Process, Evolution of the.237, 265
Different Kinds of Iron..... 82
Difficult Bronze Casting Molding Job.... 234
Difficult Mixture to Cast..... 115
Difficulties Arising from the use of Lead.. 284
Difficulties in Casting Bronze Bushings.. 236
Difficulties in Making Brazing Brass..... 30
Difficulties, Shrinkage..... 116
Difficulties Due to Insufficient Feeding.... 30
Do Grinding Wheels Actually Grind?.... 203
Does Copper Affect Shrinkage of Steel Castings? 165
Duraluminum, Mixtures of Alloys Similar to 284
Dust-Collecting Hoods, Cubic Feet of Air Handled through Average..... ..... Data Sheet No. 229, March

E

Early Stove Manufacture in the United States 247
Early Use of Permanent Molds for Castings. 274
Early Types of American Heating Stoves.. 336
Economical Radiator Cores..... 462
EDITORIALS:
A Call to Duty..... 166
A Problem for Foundrymen..... 204
Are Conventions Worth While in War Time? 250
Are You Doing Your Share?..... 122

Capitalize Your Convention Trip..... 464
Co-Operation Thrives Under Stress..... 506
Everybody's Going to Boston..... 406
Foundrymen 511
Molding Machines 546
Prospect and Retrospect..... 38
Take Advantage of this Opportunity.. 292
The Open-Door Policy is Best..... 80
Trade Outlook. 80, 166, 204, 292, 338, 464, 506
Twenty-five Years of Service..... 406
War - The Industrial Crucible..... 338
Effects of Phosphor-Tin and Phosphor-Copper 71
Effects of Seasoning on Gray Iron Castings 435
Eighty-eight-10-2 Alloy..... 271
Electric-Arc Welding for Foundry Purposes 179
Electric-Arc Welding, Repairing a Large Casting by 120
Electric Boat Co., Vanadium Bronze Submarine Castings 121
Electric Furnace as a Copper-Melting Medium 280
Electric Furnace Construction Co., formed. 398
Electric Furnace in the Steel Casting Plant. 232
Electric Furnace Installations..... 81
Electric Furnace, Melting All-Scrap in.. 399
Electric Furnace, Melting Malleable Iron in 140
Electric Furnace Power Problems, Solving 459
Electric Furnaces, Magnesite Bottoms for 248
Electric Furnaces, Rennerfelt, Sold..... 231
Electric Furnaces, To Build..... 398
Electric Heating of Crucibles. 194
Electric Motor Drive, Demonstrating the Reliability of 40
Electric Resistance Alloy..... 301
Electric Steel, Acid and Basic, Castings from 220, 269
Electric Steel Output Increases 85 Per Cent 254
Electric Conductivity, Manganese Decreases 461
Electrode, Auxiliary, Employs..... 466
Elements, Chemical, Melting Points of the .....Data Sheet No. 233, May
Employs Auxiliary Electrode..... 466
Enamels and Japans, Protective Coatings: II 138
Essential Factors in Foundry Cost Accounting 90
Evolution of the Die-Casting Process I 237, 265
Exhibition, Boston, what you will see at the 354
Exhibitors, Boston Show, List of..... 290
Exhibits at Boston Reflect War's Influence 427
Expenses, Operating, Keeping Down in a Small Gray Iron Foundry..... 215
Experiments with Permanent Molds. 187, 288
Experiments with Sulphur in Copper.. 447

F

Facings for Brass Castings..... 196
Failure of Brass..... 114
Federal Foundry Supply Co., Counter-Balanced Cupola Doors..... 465
Federal Foundry Supply Co., Sleeve Valve Molding Machine 409
Federal Malleable Co., Small Squeezer-Type Molding Machine 167
Feeding, Insufficient, Difficulty Due to.... 30
Female Labor, Employment of, in the Foundry 519
Ferro Machine & Foundry Co., How Automobile Motor Castings Are Molded..... 469
Ferro Machine & Foundry Co., How Cores for Motor Car Castings Are Made..... 255
Ferro-Manganese in 1916..... 81
Figuring the Cost of the Cupola Heat..... 102
Finishing, Wax, Bronze..... 156
Fixtures, Steam Metal..... 115
Flag-Raising Celebrates Opening of New Plant 407
Flaking, Cause of..... 447
Flask Equipment, Sensible, for Machine Molding 176
Flask, Molding Frame and..... 123
Flood Lights in Industries, Use of..... 94
Flux, Aluminum Solders and..... 533
Flux, Cupola, Limestone for..... 118
Flux for Brass Particles..... 196
Flux for Small Brass Particles..... 157
Flux for Soldering ....Data Sheet No. 243, October
Forgings for Fuse Caps..... 285
Formulas for the Brass Foundryman..... .....Data Sheets Nos. 235 and 236, June Data Sheets Nos. 235 and 236, June; 241 and 242, September; 243 and 244, October; and 245 and 246, November.
Founding, Steel, Progress of, in 25 Years. 383
Foundries, English, Increased Use of Molding Machines in..... 37
Foundries, How Profit-Sharing Has Worked in 6
Foundries, Installing a Uniform Cost System in 206
Foundries, Organizing for Welfare Work in 458
Foundry, American, in a Time of War.... 127
Foundry Behind the Automobile..... 223
Foundry, Brass, Time - Saving Stand for Checking Melting Losses in a..... 20
Foundry, Brass, What the, Has Done in 25 Years 386
Foundry, Canadian, Casting Chilled Car Wheels in a..... 297
Foundry, Cincinnati, for Making Special Castings 527
Foundry Cost Accounting, Essential Factors in 90
Foundry, Designing a Modern, of Moderate Size 43
Foundry Equipment Co. Extends Plant... 105
Foundry Equipment Co., Improved Core Oven 408
Foundry Equipment Manufacture, Progress in 375
Foundry Equipment Plant, New, Flag-Raising Celebrates Opening of..... 407
FOUNDRY, HOW THE, was Dressed When It Made Its Bow 25 Years Age..... 370
Foundry, How the Sales Engineer Views the 520
Foundry Industry Leaps Forward..... 501
Foundry Meeting, Spirit of Service Pervades 411
Foundry, New Cleveland Stove, for Maximum Output 307
Foundry, New Converter, for Economical Operation 133
Foundry Industry Has Prepared for War, How the 171
Foundry Lighting Problem, How to Solve 522
Foundry, Malleable Iron, Organizing a, in 90 Days..... 515
Foundry Organization, Pattern Shop and. 48
Foundry, Role of Metallography in the... 498
Foundry, Safe Handling of Crucibles in the 316
Foundry, Small Gray Iron, Keeping Down Operating Expenses in a..... 215
Foundry, Small Malleable, Cost System for 9
Foundry Supply Business, Growth of the.. 378
FOUNDRY, THE, Parallels Iron Industry's Progress 372
Foundry Trade, What the War Has in Store for the..... 253
Foundry's Quarter Century Survey, Malleable 380
Foundryman, Supplying the, for 25 Years. 382
Foundryman's Viewpoint, Pattern Design from the 37
Foundrymen, Boston Welcomes the Great Army of 343
Foundrymen Can Do to Prevent Hot Boxes, What 111
Foundrymen Display Keen Interest in Boston Show 290
Foundrymen Show Interest in Safety Problems 456
Foundrymen's Convention and Exhibition to be Held at Boston..... 81
French Army, Molding Shells and Grenades for the..... 131
Frohman, E. D., Brass Cleaner and Deoxidizer 114
Fuel, Cupola, Oil Residue as a..... 205
Fuel Oil Briquettes, How, Are Used..... 289
Fuel, Powdered Coal as a, in Malleable Shops—IV 32
Fuller, Benjamin D., Elected President A. F. A. 421
Fundamental Principles of Plate Mounting 147
Furnace, Crude-Oil, Melting in a..... 194
Furnace, Melting, Lining for..... 196
Furnace for Melting Copper-Zinc Alloys.. 514
Furnace, Oil-Fired Malleable, How an, Operates 503
Furnace Oil, Measuring, without Using a Meter 202
Furnace, Open-Flame, for Melting Statuary Bronze 246
Furnaces, Electric, Magnesite Bottoms for 248
Furnaces, Melting, Performance of..... 398
Furnaces, Melting, Sizes of Stack and Flues for 116
Fuse Caps, Forgings for..... 285

G

Gas as Fuel for Melting Alloys..... 193
Gases, Occluded, Influence of, in Cast Metal 149
Gasoline, Mixture to Hold..... 196
Gating, Heading and Chilling Steel Castings 304
Gating Malleable Castings, Modern Method of 319
Gating Problem, Troublesome..... 521
Gear Blanks and Bushings, Remedying Brittle 327
Gear Cover Casting, Quick Method of Making a 146
Gear Cutter Bed, 5-Ton, Molding and Coring a 363
General Electric Co., Fool-Proof Electric Switch 509
General Electric Co., New Turbine for Driving Blowers 409
General Industrial Notes..... 41, 83, 126, 169, 207, 251, 296, 341, 410, 467, 510
Glass, Safety, New Form of..... 465
Gorham Mfg. Co., Open-Flame Furnace for Melting Statuary Bronze..... 246
Government Metal, Forging..... 448
Government Prices for Zinc..... 231
Grain of Brass, Refining the..... 156
Graphite Production, Increased..... 263
Gray & Benjamin, Advertising Counsellors 294
Gray Iron Art Work, Making..... 85
Gray Iron Castings, Artistic, Made by Russian Foundrymen 359
Gray Iron Castings, Effects of Seasoning on 435
Gray Iron Castings, Unique..... ..... Supplement, November
Gray Iron has "Grown" in 25 Years, How 379
Gray Iron, Heat-Resisting 14
Gray Iron Progress in 25 Years..... 374
Gray Iron Reproductions of Early Artisans' Masterpieces, Remarkable .... Supplement, October
Gray, James H., Magnesite Bottoms for Electric Furnaces 248
Grenades, Molding Shells and, for the French Army 131
Grinding Mills, Cast Iron Balls for..... 14
Grinding Wheel Accidents, Table of Causes of....Data Sheets Nos. 225 and 226, January
Grinding Wheel Standards..... ....Data Sheets Nos. 227 and 228, February
Grinding Wheels, Actual Grinding of..... 203
Growth of the Foundry Supply Business.. 378
Guns, Makes Large Iron Mold for..... 188
Gurney Electric Elevator Works, Casting Floor Plate and Bed for a Boring Mill.. 491
Gurney Electric Elevator Works, Molding and Coring a 5-Ton Gear Cutter Bed.... 363

H

Hamilton & Hansell, Rennerfelt Furnaces Sold 231
Handles, Automobile Door, White Brass for 236
Handpad, Serviceable 206
Hard White Iron for Pipes..... 502
Hardness, Iron and Phosphorus Cause.... 285
Hardness of Copper Zinc Alloys..... 155
Hardness of Metals in Service, Testing the 263
Heading, Gating and Chilling Steel Castings 304
Heat-Resisting Gray Iron..... 14
Helmet for Arc Welders..... 243
Hickory Steel Grip Glove Co., Serviceable Handpad 206
History of Nickel Plating for Stove Decorating 175
Hoists, Resumes Manufacture of..... 408
Hoists, Small Electric, for Foundries..... 81
Holes, Sulphur, How to Eliminate, in Castings 119
Hooven-Owens-Rentschler Co., How Heavy Ammonia Stills Are Molded..... 107
Hot Boxes, What Foundrymen Can Do to Prevent 111
How an Oil-Fired Malleable Furnace Operates 503
How Automobile Motor Castings Are Molded 469
How Cores for Motor Car Castings Are Made 255
How Fuel Oil Briquettes Are Used..... 289
How Gray Iron has "Grown" in 25 Years. 379
How Heavy Ammonia Stills Are Molded.. 107
How Malleable Iron Has Improved..... 475
How Profit-Sharing Has Worked in Foundries 6
How the Foundry Industry Has Prepared for War 171
How THE FOUNDRY was Dressed When It Made Its Bow 25 Years Age..... 370
How the Sales Engineer Views the Foundry 520
How the War Affects Manufacture of Crucibles 494
How to Buy Pattern Lumber Economically 117
How to Eliminate Sulphur Holes in Castings 119
How to Make Chilled Cast Iron Balls..... 288
How to Melt Babbitt Metal..... 369
How to Mix and Melt Manganese Bronze. 72
How to Prevent Dull Iron..... 318
How to Prevent Pin Holes in Brass Castings 327
How to Use Titanium in Making Steel Castings 15
How Walker Process Reduces Ingot Mold Costs 158
How We May Conserve Our Metal Resources 209
How Zinc-Coated Parts are Tested..... 34
Hydrostatic Test, Castings Subjected to... 283

I

Ideals in Melting Metals..... 193
Illinois Mfg. & Supply Co., Complete Sand-Blasting Room 465
Impellers, Mine Pump..... 235
Improper Melting Methods..... 283
Improved Sanding Roll for the Pattern-maker's Lathe 8
Impurities, Influence of, on Tensile Strength 457

Increased Use of Molding Machines in English Foundries 37
Increasing the Output of the Plating Room 261
Independence Inspection Bureau, Table of Causes of Grinding Wheel Accidents.... .....Data Sheets Nos. 225 and 226, January
Industries, Use of Flood Lights in..... 94
Influence of Design on the Cost of Patterns 33, 301
Influence of Impurities on Tensile Strength 457
Influence of Occluded Gases in Cast Metal 149
Ingot Metal, Oxides in..... 157
Ingot Mold Costs, How Walker Process Reduces 158
Inspection of Brass and Bronze..... 532
Inspection of Bronze and Brass Castings. 154
Installing a Uniform Cost System in Foundries 206
Intelligent Use of Nickel-Plating Solutions 333
Introducing Iron Into Manganese Bronze. 71
Iron, All, is Good Iron..... 14
Iron and Phosphorus Cause Hardness..... 285
Iron Balls, Chilled..... 321
Iron, Casting, Around a Rigid Center..... 20
Iron, Different Kinds of..... 82
Iron, Dull, How to Prevent..... 318
Iron, Hard White, for Pipes..... 502
Iron Industry's Progress, THE FOUNDRY Parallels 372
Iron, Introducing, Into Manganese Bronze 71

J

Japans and Enamels, Protective Coatings: —II 138
Journal Bearings, Casting..... 111

K

Keeping Down Operating Expenses in a Small Gray Iron Foundry..... 215
Keller Pneumatic Tool Co., New Plant of. 398
King, Julius, Optical Co., Helmet for Arc Welders 243
Kranz, W. G., Melting Malleable Iron in Electric Furnace 140

L

Labor Appreciates the Human Element... 524
Labor, Female, Employment of, in the Foundry 519
Lacquers, Protective Coatings:—I..... 103
Ladle, Self-Skimming, for Pouring Steel for Castings 244
Ladle Sleeves and Stoppers..... 451
Ladoff, Isador, New Method of Making High-Speed Steel 291
Lake Torpedo Boat Co., Specifications for Wood Patterns 269
Large Scrap Melting Cupola..... 462
Lathe Beds, Chill Cracks in..... 182
Lathe, Patternmaker's, Improved Sanding Roll for 8
Lava Crucible Co., Test of Crucible..... 206
Lead, Difficulties Arising from the Use of. 284
Lead, Segregation of 496
Lenoir Car Works Installs Open Hearth.. 118
Lighting Problem, Foundry, How to Solve 522
Lights, Flood, in Industries, Use of..... 94
Limestone for Cupola Flux..... 118
Lincoln Electric Co., Demonstrating the Reliability of Motor Drive..... 40
Lining for Melting Furnace..... 196
Link-Belt Co., Molding Sand Revivifier.... 508
Link-Belt Co., Resumes Manufacture of Hoists 408
Locks, Cheap Mixture for..... 157
Loss in Melting..... 178
Losses in Melting Cast Iron..... 222
Ludlum Steel Co., Melting All-Scrap in Electric Furnace 399
Lumber, Pattern, How to Buy, Economically 117
Lumber, Pattern, Selection..... 205
Lunkenheimer Co., Cincinnati Foundry for Making Special Castings..... 527
Lupton's, David, Sons Co., Pond Truss for Buildings 20

Mc

McLain, David, Lenoir Car Works Installs Open Hearth..... 118

M

Machine for Testing the Hardness of Metals in Service..... 263
Machine, Screw Counting..... 124
Machinery, Wood-Working, Sizes of Connections for....Data Sheet No. 230, March
Magnalium Castings 196
Magnesite Bottoms for Electric Furnaces. 248
Making Aluminum Match Plates..... 79
Making Cast Iron Shells in Permanent Molds 439
Making Cook Stoves for Uncle Sam's New Army 389
Making Gray Iron Art Work..... 85
Making Large Pure Aluminum Castings.. 98
Making Nonferrous Castings in a Railroad Shop 1
Making Vanadium Bronze 497
Malleable Cast Iron, Shrinkage of..... 19
Malleable Castings, Modern Method of Gating 319
Malleable Castings, Railroad, Tentative Specifications for 295
Malleable Foundry, Small, Cost System for 9
Malleable Foundry's Quarter Century Survey 380
Malleable Furnace, How an Oil-Fired, Operates 503
Malleable Iron and Its Uses..... 505
Malleable Iron, Bronze Substitute for.... 533
Malleable Iron, Casting, in Permanent Molds 40
Malleable Iron Castings, Producing Machinable 449
Malleable Iron Foundry, Organizing a, in 90 Days..... 515
Malleable Iron Has Improved, How..... 475
Malleable Iron Improves in Quality..... 376
Malleable Iron Manufacture, Progress in. 377
Malleable Iron, Melting, in Electric Furnace 140
Malleable Iron Practice, Use of Chills in 303
Malleable Iron, Pulverized Coal for Melting 487
Malleable Men Discuss Practical Problems 422
Malleable Practice, Removing Traditional Evils of 73, 398
Malleable Shops, Powdered Coal as a Fuel in—IV 32
Manganese Bronze, How to Mix and Melt 72
Manganese Bronze, Introducing Iron Into 71
Manganese Bronze, Properties of..... 272
Manganese Bronze, Unusually Strong.... 31
Manganes Decreases Electrical Conductivity 461
Manganese Steel Castings, Manufacture of 141
Manitowoc Electric Implement Co., Electric Vibrators 39
Manufacture of Manganese Steel Castings 141
Marsh Electric Resistance Alloy..... 301
Match Plates, Aluminum, Making..... 79
Match-Plates, Zinc Alloy for..... 31
Measuring Furnace Oil without Using a Meter 202
Mechanical Purposes, Properties of Bronzes for 68
Melting Alloys, Gas as Fuel for..... 193
Melting All-Scrap in Electric Furnace.. 399
Melting Brass in a Gas-Fired Cupola Furnace 189
Melting Brass in the Cupola..... 496
Melting Capacity of a Small Cupola, To Increase the 291
Melting Cast Iron, Losses in..... 222
Melting Copper in Cupola..... 195
Melting Down Scrap 29
Melting in a Crude-Oil Furnace..... 194
Melting in a Cupola with Bituminous Coal 67
Melting, Loss in 178
Melting Malleable Iron in Electric Furnace 140
Melting Metals, Ideals in..... 193
Melting Methods, Improper..... 283
Melting Points of the Chemical Elements .....Data Sheet No. 233, May
Melting Practice at the Royal Mint..... 191
Melting, Slow, and Bridging..... 97
Melting with Coal Screenings..... 156
Melting Yellow Brass, Mixing and..... 116
Metal, Aeroplane 30
Metal, Ajax and Carmelia..... .....Data Sheet No. 246, Nov.
Metal, Anti-Friction 157
Metal, Anti-Friction, Analyses for..... 284
Metal, Babbitt, How to Melt..... 369
Metal, Benedict, Analysis of..... 72
Metal, Cast, Influence of Occluded Gases in 149
Metal, Cooling, Control of, in Cast Iron Work 302
Metal, Ex. B..Data Sheet No. 245, November
Metal from Brass Concentrates..... 497
Metal, Government, Forging..... 448
Metal, Ingot, Oxides in..... 157
Metal Resources, How We May Conserve Our 209
Metal, Scrap Babbitt, Utilizing..... 236
Metal, Steam, Fixtures 115
Metal, White, for Art Work..... 196
Metallography, Role, of, in the Foundry.. 498
Metals and Alloys, Sand-Cast, Results of Tests of 270
Metals, Bearing, Analyses of..... 236
Metals, Ideals in Melting..... 193
Metals, Nonferrous, Chill Molds for Casting 28
Metals, Weight of Square Foot of Various .....Data Sheet No. 240, August
Meter, Measuring Furnace Oil Without Using a 202
Method of Babbitting Thrust Collars.... 284
Michigan Steel Castings Co., Electric Furnace in the Steel Casting Plant..... 232
Microscope, Metallographic, Application of the 498
Mills, Grinding, Cast Iron Balls for..... 14
Mine Pump Impellers 235
Minnesota Manufacturers' Association, Gravity Conveyors for Foundry Materials 508
Mint, Royal, Melting Practice at the.... 191
Minute Cavities in Brass Castings..... 448
Missouri Malleable Iron Co., How an Oil-Fired Malleable Furnace Operates.. 503
Mixture, Aluminum, for Pistons..... 497
Mixing and Melting Yellow Brass..... 116
Mixture, Bronze, to Resist Acetic Acid.. 236
Mixture, Core Sand, for Globe Valves... 447
Mixture, Cheap, for Locks..... 157
Mixture, Difficult, to Cast..... 115
Mixture, 88-10-2, Tensile Strength of..... 156
Mixture for Aeroplane Motor Castings... 116
Mixture for Aluminum Pistons..... 31
Mixture for Bronze Parts..... 13
Mixture for Cheap Car Journal Bearings. 70
Mixture for Cylinders..... 202
Mixture for Oxyacetylene Torch Castings 327
Mixture for Stove Castings..... 452
Mixture for White Metal Patterns..... 326
Mixture of Bronze to Resist Mine Water. 497
Mixture of Iron for Permanent Molds... 398
Mixture of No 31 Aluminum..... 72
Mixture to Hold Gasoline..... 196
Mixture, Tobin Bronze..... 157
Mixtures, Cheap Red Brass..... 285
Mixtures of Alloys Similar to Duralumin 284
Modern Methods of Gating Malleable Castings 319
Mold Costs, Ingot, How Walker Process Reduces 158
Mold, Large Iron, for Guns..... 188
Molding a Fan Pedestal, Pattern Economy in 288
Molding and Coring a 5-Ton Gear Cutter Bed 363
Molding Frame and Flask..... 123
Molding, Hand and Power Machine, Advantages of 285
Molding Job, Difficult Bronze Casting... 234
Molding Machines, Combination Electric Jar-Ramming and Power Rock-Over... 39
Molding Machine, New Type of Roll-Over 507
Molding, Machine, Sensible Flask Equipment for 176
Molding Machine, Sleeve Valve..... 409
Molding Machine, Small Squeezer-Type.. 167
Molding Machines, Hand Squeezer..... 507
Molding Machine, Increased Use of, in English Foundries 37
Molding Operations, "Movies" of..... 121
Molding Sand Gets Right of Way to Oct 15 214
Molding Shells and Grenades for the French Army 131
Molding Wheels and Sheaves with Steel Spokes 99
Molds and Cores, Cast Iron, Use of..... 164
Molds, Chill, for Casting Nonferrous Metals 28
Molds, Permanent, Casting Malleable Iron in 40
Molds, Permanent, Experiments with..187,.288
Molds, Permanent, for Castings, Early Use of 274
Molds, Permanent, Making Cast Iron Shells in 439
Molds, Permanent, Mixture of Iron for.. 398
Molds, Permanent, Progress in Casting Brass in 70
Monarch Engineering & Mfg. Co., Open-Flame Furnace for Melting Statuary Bronze 246
Moore, Edwin A., Iron Foundry, Making Gray Iron Art Work..... 85
Motor Car Castings, How Cores for, Are Made 255
Motor Castings, Aeroplane, Mixture for.. 116
Motor Drive, Demonstrating the Reliability of 40
Mounting, Plate, Fundamental Principles of 147
"Movies" of Molding Operations..... 121

N

National Engineering Co., Equipment for Reclaiming Core Sand..... 293
National Malleable Castings Co., Melting Malleable Iron in Electric Furnace..... 140
National Safety Council, Foundrymen Show Interest in Safety Problems..... 456
New Cleveland Stove Foundry for Maximum Output 307
New Converter Plant for Economical Operation 133
New Foundry Appliance Co., Molding Frame and Flask 123
New London Ship & Engine Co., Designing a Modern Foundry of Moderate Size 43
New Method of Making High-Speed Steel 291
Nickel Alloy, Very Stiff, White..... .....Data Sheet No. 237, July
Nickel Anodes, Scrap, Reclaimed by Welding 484
Nickel Anodes, Trouble with..... 71
Nickel, Benedict ....Data Sheet No. 238, July
Nickel Plating for Stove Decorating, History of 175
Nickel-Plating Solutions, Intelligent Use of 333
Nitride, Aluminum 497

Nomenclature of Aluminum Alloys..... 285
Nonferrous Metal Resources, How We May Conserve 209
Nonferrous Metal, Some Test Bar Suggestions for 322
Nonferrous Metals, Chill Molds for Casting 28
Nonferrous Metals, Modern Methods of Melting 189
Non-Shrinkable Pattern Alloy..... 447
Novo Engine Co. Shares Profits..... 169
No. 12 Aluminum 115

O

Obermayer, S., Co., Brass Cleaner and Deoxidizer 114
OBITUARIES:
Green, W. W. 294
Griffith, T. L. 40
Simpson, Peter Liston..... 339
Oil-Fired Malleable Furnace, How an, Operates 503
Oil Fuel, Briquettes, How, Are Used... 289
Oil, Furnace, Measuring, Without Using a Meter 202
Oil Residue as a Cupola Fuel..... 205
Oldham, George, & Son, New Core Buster 249
Open-Flame Furnace for Melting Statuary Bronze 246
Ordnance Construction, Steel Castings for 453, 477
Organization, Pattern Shop and Foundry 48
Organizing for Welfare Work in Foundries 458
Output, Average, of Cupolas.....
.....Data Sheet No. 234, May
Output, Electric Steel, Increases 85 Per Cent 254
Output of the Plating Room, Increasing the 261
Ovens, Annealing, Roof Arch for..... 509
Overcoming Porosity 116
Oxides in Ingot Metal..... 157
Oxyacetylene Torch Castings, Mixture for 327

P

Palo Co., Testing the Hardness of Metals in Service 263
Parts, Zinc-Coated, are Tested, How..... 34
Pattern Alloy, Non-Shrinkage..... 447
Pattern Alloy, White Metal..... 285
Pattern Design from the Foundryman's Viewpoint 37
Pattern Economy in Molding a Fan Pedestal 288
Pattern Lumber, How to Buy, Economically 117
Pattern Lumber Selection..... 205
Pattern Shop and Foundry Organization.. 48
Pattern, Simple, Constructing a..... 13
Pattern Storage, Systematic, Aids the Foundry 183
Patternmaker of the Hour..... 162
Patternmaker's Construction Board..... 369
Patternmaker's Work Bench, Top for the 246
Patternmakers, Time-Saving Kink for.... 203
Patterns, Fundamental Principles of Mounting 147
Patterns, Influence of Design on the Cost of 33, 301
Patterns, White Metal, Mixture for..... 326
Patterns, Wood, Specifications for..... 269
Pedestal, Fan, Pattern Economy in Molding a 288
Peerless Foundry Co., Molding Frame and Flask 123
Pennsylvania Railroad Co., Making Nonferrous Castings in a Railroad Shop... 1
Personal 41, 81, 125, 205, 251, 293, 339, 408, 455, 493
Philadelphia Foundrymen Meet 169
Phosphor-Copper and Phosphor-Tin, Effects of 71
Phosphor-Tin and Phosphor-Copper, Effects of 71
Phosphorus and Iron Cause Hardness... 285
Pianos, Making Castings for..... 285
Pig Iron Production Declined During First Half of Year..... 387
Pin Holes in Brass Castings, How to Prevent 327
Pipe, Soil, and Fittings, Tentative Specifications for 270
Pipes for Grinding, Polishing, Buffing or Rag Wheels....Data Sheet No. 229, March
Pipes, Hard White Iron for..... 502
Piston Rings, Brass Alloys for..... 534
Pistons, Aluminum, Mixture for..... 31
Pistons, Aluminum Mixture for..... 497
Pitted Brass Plungers 31
Pittsburgh Foundrymen's Association, "Movies" of Molding Operations..... 121
Pittsburgh Rolls Corp. Takes Over Seaman-Sleeth Co. 369
Plaster of Paris in the Brass Foundry.. 326
Plate Mounting, Fundamental Principles of 147
Plating, Copper, Aluminum..... 283
Plating, Nickel-, Solutions, Intelligent Use of 333
Plating Room, Increasing the Output of the 261
Plating Room, Safety in the..... 58
Plungers, Brass, Pitted..... 31
Pond Truss for Buildings..... 20
Porosity, Overcoming 116
Porous Brass and Bronze Sticks..... 31
Porous Brass Castings..... 29
Porous Copper Castings 195
Powdered Coal as a Fuel in Malleable Shops—IV 32
Power Mfg. Co., Keeping Down Operating Expenses in a Small Gray Iron Foundry 215
Power Problems, Electric Furnace, Solving 459
Pressure, Water, Castings Subjected to.. 327
Prest-O-Lite Co., Inc., Scrap Nickel Anodes Reclaimed by Welding..... 484
Preventing Accidents in Industrial Yards 461
Preventing Cupola Bridging 310
Prices, Agreed, and Their Meaning..... 511
Prices, Average Monthly, of Foundry Iron, Machinery and Malleable Scrap, Ferro-Manganese and Coke..... 172
Prices, Government, for Zinc..... 231
Pridmore, Henry E., Combination Electric Jar-Ramming and Power Rock-Over Molding Machine 39
Principles of Plate Mounting, Fundamental 147
Producing Machinable Malleable Iron Castings 449
Production of Semisteel Shells..... 337
Profit-Sharing Has Worked in Foundries, How 6
Progress, Gray Iron, in 25 Years..... 374
Progress in Casting Brass in Permanent Molds 70
Progress in Foundry Equipment Manufacture 375
Progress in Malleable Iron Manufacture. 377
Progress in the Manufacture of Steel Castings 325
Progress, Iron Industry's, THE FOUNDRY Parallels 372
Progress of Steel Founding in 25 Years.. 383
Propeller Casting is Essential to Our Defense 366
Properties of Bronze for Mechanical Purposes 68
Properties of Semisteel Castings..... 53
Proprietary Bearing Alloys.....
..Data Sheets Nos. 245 and 246, November
Protective Coatings: Lacquers—I..... 103
Protective Coatings: Japans and Enamels—II 138
Pulverized Coal for Melting Malleable Iron 487
Pump, Mine, Impellers 235

Q

Quick Method of Making a Gear Cover Casting 146

R

Radiator Cores, Economical 462
Railroad Malleable Castings, Tentative Specifications for 295
Railroad Shop, Making Nonferrous Castings in a..... 1
Recently Developed Uses of Aluminum in Industry 531
Recommends Standard Screen Scale for Sieves 163
Refining Process, Deoxidizing and, Schwartz 294
Refining the Grain of Brass..... 156
Remedying Brittle Bushings and Gear Blanks 327
Remelting Shot Iron 52
Removing Aluminum from Brass..... 448
Removing Traditional Evils of Malleable Practice 73, 398
Rennerfelt Furnaces Sold 231
Repairing a Large Casting by Electric Arc Welding 120
Repairing Cracks in Steel Castings Electrically 306
Revivifier, Molding Sand 508
Reynolds Pattern & Machine Co., Screw Counting Machine 124
Richmond Malleable Casting Co., Organizing a Malleable Iron Foundry in 90 Days 515
Role of Metallography in the Foundry... 498
Rolling Mill Bearings..... 116
Rough and Dirty Yellow Brass Castings. 448

S

Safe Handling of Crucibles in the Foundry 316
Safety Awards Announced..... 153
Safety in the Plating Room..... 58
Safety Problems, Foundrymen Show Interest in 456
Sand-Blast Apparatus, New Departure in the Design of..... 168
Sand-Blast Barrel, Develops Large..... 124
Sand-Blast Machines, Made..... 263
Sand-Blasting Room, Complete..... 465
Sand-Cast Metals and Alloys, Results of Tests of 270
Sand, Core, Mixture for Globe Valves... 447
Sand, Molding, Gets Right of Way to Oct. 15 214
Sand, Molding, Revivifier 508
Sand, Preparing, for Steel Foundry Work 526
Sand Problem, Steel Foundry, Study of the 312
Sanding Roll, Improved, for the Patternmaker's Lathe 8
Scale, Standard Screen, for Sieves, Recommends 163
Schwartz Deoxidizing and Refining Process 294
Scrap, All-, Melting, in Electric Furnace. 399
Scrap Babbitt Metal, Utilizing..... 236
Scrap Melting Cupola, Large..... 462
Scrap, Melting Down..... 29
Scrap Nickel Anodes Reclaimed by Welding 484
Scrap, Poor, Trying to Use..... 30
Scrap, Thin, Rolled Brass, Utilizing..... 236
Screw Counting Machine..... 124
Seaman-Sleeth Co. is sold and J. S. Seaman Retires 369
Seasoning, Effects of, on Gray Iron Castings 435
Seasoning of Castings..... 96
Segregation of Lead..... 496
Selenium in Copper..... 369
Self-Skimming Ladle for Pouring Steel for Castings 244
Semisteel Castings 248
Semisteel Castings, Properties of..... 53
Semisteel in the last Quarter Century.... 384
Semisteel Shells, Production of..... 337
Sensible Flask Equipment for Machine Molding 176
Sheaves with Steel Spokes, Molding Wheels and 99
Sheeler-Hemsher Co., Making Large Pure Aluminum Castings 98
Shells and Grenades, Molding, for the French Army 131
Shells, Cast Iron, Making, in Permanent Molds 439
Shells, Semisteel, Production of..... 337
Shepard Crane & Hoist Co., Small Electric Hoists for Foundries..... 81
Shot Iron, Remelting..... 52
Shrinkage and Contraction..... 5
Shrinkage Difficulties 71, 116
Shrinkage of Malleable Cast Iron..... 19
Shrinkage of Steel Castings, Effect of Copper on 165
Sieves, Recommends Standard Screen Scale for 163
Silberberg, Mortimer J., Motion Study Watch 167
Sizes of Connections for Wood-Working Machinery.....Data Sheet No. 230, March
Sizes of Stack and Flues for Melting Furnaces 116
Slag Test for Refractory Brick in Steel Industry 340
Sleeves and Stoppers, Ladle..... 451
Slings, Belt, for Cores..... 102
Slow Melting and Bridging..... 97
Smith, Werner G., Co., Oil for Cores.... 339
Snyder Electric Furnace Co., Electric Furnace Installations 81
Soldering Aluminum Bronze.....
.....Data Sheet No. 244, October
Soldering Aluminum-Bronze Castings 284
Soldering, Flux for .....
.....Data Sheet No. 243, October
Solders and Flux, Aluminum..... 533
Solution, Cleaning, for Brass Castings.... 30
Solutions, Nickel-Plating, Intelligent Use of 333
Solving Electric Furnace Power Problems 459
Some Test Bar Suggestions for Nonferrous Metal 322
Specifications for Wood Patterns..... 269
Specifications, Tentative, for Brass Castings 446
Specifications, Tentative, for Railroad Malleable Castings 295
Specifications, Testing Society Considers New 270
Spirit of Service Pervades Foundry Meeting 411
Stand, Time-Saving, for Checking Melting Losses in a Brass Foundry..... 20
Standard Foundation Washers.....
.....Data Sheet No. 231, April
Standard Screen Scale for Sieves, Recommends 163
Standard Steel Castings Co., Large Foundry to Produce Cast Steel Truck Wheels 445
Standard Wood Washers.....
.....Data Sheet No. 232, April
Standards, Grinding Wheel.....
...Data Sheets Nos. 227 and 228, February
Stark, Charles J., Appointed Editor of *The Iron Trade Review*..... 119
Steam Metal Fixtures..... 115
Steel, Acid and Basic Electric, Castings from 220, 269
Steel Casting Plant, Electric Furnace in the 232
Steel Casting Specifications, Navy Revises 318
Steel Castings, Cores for..... 246

Steel Castings, Effect of Copper on Shrinkage of 169
Steel Castings for Ordnance Construction 453, 477
Steel Castings, Heading, Gating and Chilling 304
Steel Castings, How to Use Titanium in Making 15
Steel Castings, Manganese, Manufacture of 141
Steel Castings, Output of..... 254
Steel Castings, Progress in the Manufacture of 328
Steel Castings, Repairing Cracks in, Electrically 306
Steel Foundry Work, Preparing Sand for. 526
Strauss & Buegeleisen, New Form of Safety Glass 465
Strength, Calculating Tensile from Transverse 445
Strength of Chains.....Data Sheet No. 239, August
Strength, Tensile, Influence of Impurities on 457
Strength, Varying, in Different Parts of a Large Casting..... 305
Strong Aluminum Alloys..... 327
Strong Castings 165
Strong, Kennard & Nutt Co., Can't Splinter New Lens..... 547
Study of Inclusions of Alumina in Steel.. 197
Study of the Steel Foundry Sand Problem 312
Sturtevant, B. F., Co., Cubic Feet of Air Handled through Average Dust-Collecting Hoods and Pipes for Grinding, Polishing, Buffing or Rag Wheels.....Data Sheet No. 229, March
Sturtevant, B. F., Co., Sizes of Connections for Wood-Working Machinery.....Data Sheet No. 230, March
Submarine Castings, Vanadium Bronze... 121
Suggestions for Melting Brass..... 495
Sullivan Machinery Co., Air Compressor for Foundry Use..... 168
Sulphur Holes in Castings, How to Eliminate 119
Sulphur in Copper, Experiments with..... 447
Sulphur, Use of an Excess of..... 71
Supplying the Foundryman for 25 Years. 382
Surface, Bright, Smooth, on Castings.... 79
Switch, Fool-Proof Electric..... 509
Systematic Pattern Storage Aids the Foundry 183
Steel for Castings, Self-Skimming Ladle for Pouring 244
Steel Founding, Progress of, in 25 Years. 383
Steel Foundry Sand Problem, Study of the 312
Steel, High-Speed, New Method of Making 291
Steel Industry, Slag Test for Refractory Brick in 340
Steel Sessions Draw Big Crowds..... 420
Steel Spokes, Molding Wheels and Sheaves with 99
Steel, Study of Inclusions of Alumina in. 197
Steel Wheels, Casting, for Motor Trucks. 61
Stevens, Frederic B., Again Dips His Pen 398
Sticks, Brass and Bronze, Porous..... 31
Stills, Heavy Ammonia, Are Molded, How 107
Stoppers, Ladle Sleeves and..... 451
Storage Bins, Durable, Design for..... 502
Storage, Systematic Pattern, Aids the Foundry 183
Stove Castings, Mixture for..... 452
Stove Decorating, History of Nickel Plating for 175
Stove Foundry for Maximum Output, New Cleveland 307
Stove Manufacture, Early, in the United States 247
Stoves, American Heating, Early Types of 336
Stoves, Cook, for Uncle Sam's New Army, Making 389

T

Table of Causes of Grinding Wheel Accidents .....Data Sheets Nos. 225 and 226, January
Ten Per Cent Aluminum Bronze..... 273
Tennessee Coal, Iron & Railroad Co., How Walker Process Reduces Ingot Mold Costs 158
Tensile Strength of 88-10-2 Mixture..... 156
Tentative Specifications for Brass Castings 446
Test Bar Suggestions for Nonferrous Metal, Some 322
Test, Hydrostatic, Castings Subjected to. 283
Tested, How Zinc-Coated Parts are..... 34
Testing Society Considers New Specifications 270
Testing the Hardness of Metals in Service 263
Tests, Aluminum-Bronze, and Their Significance 21
Time-Saving Kink for Rush Job..... 203
Time-Saving Stand for Checking Melting Losses in a Brass Foundry..... 20
Tin, Phosphor-, and Phosphor-Copper, Effects of 71
Titanium and Aluminum Bronze..... 505
Titanium Bronze Co., Titanium and Aluminum Bronze 505
Titanium, How to Use, in Making Steel Castings 15
To Increase the Melting Capacity of a Small Cupola 291
To Reduce Combined Carbon..... 47
Tobin Bronze 115
Tobin Bronze Mixture 157
Top for the Patternmaker's Work Bench. 246
Trade Notes 125, 205, 466
Trade Publications 42, 170, 208, 252, 342, 410, 468
Transportation and Conveying Problems, Foundry, Solving 535
Travelers Insurance Co., Safe Handling of Crucibles in the Foundry..... 316
Trouble with Nickel Anodes..... 71
Trucks, Motor, Casting Steel Wheels for. 61
Truss, Pond, for Buildings..... 20
Trying to Use Poor Scrap..... 30
Turbine, New, for Driving Blowers..... 409
Turnings, Copper, Utilizing..... 283

U

Unique Gray Iron Castings..... Supplement, November
United States Bureau of Standards, Melting Points of the Chemical Elements.....Data Sheet No. 233, May
United States Bureau of Standards, The Failure of Brass..... 114
United States Navy Revises Steel Casting Specifications 318
United States Silica Co., Little Journeys of the Flint Shot Man..... 504
Unusually Strong Manganese Bronze..... 31
Use of an Excess of Sulphur..... 71
Use of Cast Iron Molds and Cores..... 164
Use of Chills in Malleable Iron Practice. 303
Use of Chills in Producing Sound Castings 302
Use of Flood Lights in Industries..... 94
Utilizing Copper Turnings..... 283
Utilizing Scrap Babbitt Metal..... 236
Utilizing Thin, Rolled Brass Scrap..... 236

V

Valves, Globe, Core Sand Mixture for.... 447
Vanadium Bronze, Making..... 497
Vanadium Bronze Submarine Castings.... 121
Varying Strength in Different Parts of a Large Casting 305
Vibrator Operation, Care to be Exercised in 249
Vibrators, Electric 39
Vickers, Charles, Metallurgical Editor of THE FOUNDRY 251

W

Wagner Fire Brick Co., Brick Made from Ashes 248
Walker & Pratt Mfg. Co., Making Cook Stoves for Uncle Sam's New Army.... 389
Walker Process Reduces Ingot Mold Costs, How 158
War Has in Store for the Foundry Trade, What the 253
War, How the Foundry Industry Has Prepared for 171
Washers, Standard Foundation.....Data Sheet No. 231, April
Washers, Standard Wood.....Data Sheet No. 232, April
Watch, Motion Study..... 167
Watson, T. H., & Co., To Build Electric Furnaces 398
Wax-Finishing Bronze 156
Weight of Square Foot of Various Metals .....Data Sheet No. 240, August
Weight of the Coke Bed, Determining Proper 132
Welding Copper 115
Welding, Electric-Arc, for Foundry Purposes 179
Welding, Electric Arc, Repairing a Large Casting by 120
Welding Institute Established..... 387
Welding, Scrap Nickel Anodes Reclaimed by 484
Welfare Work in Foundries, Organizing for 458
West Steel Casting Co., Casting Steel Wheels for Motor Trucks..... 61
Western Electric Co., Use of Flood Lights in Industries 94
Westinghouse Electric & Mfg. Co., Systematic Pattern Storage Aids the Foundry 183
Westinghouse Electric & Mfg. Co. Will Build 105
What Foundrymen Can Do to Prevent Hot Boxes 111
What the Brass Foundry Has Done in 25 Years 386
What the War Has in Store for the Foundry Trade 253
Wheels and Sheaves with Steel Spokes, Molding 99
Wheels, Grinding, Polishing, Buffing or Rag, Pipes for..Data Sheet No. 229, March
Wheels, Steel, Casting, for Motor Trucks 61
White Aluminum Alloy..... 196
White Brass Alloy 72
White Brass for Automobile Door Handles 236
White Metal for Art Work..... 196
White Metal Pattern Alloy..... 285
White Metal Patterns, Mixture for..... 326
Wire Drawing Blocks..... 71
Woodison, E. J., Co., Flag-Raising Celebrates Opening of New Plant..... 407

Y

Yards, Industrial, Preventing Accidents in 461
Yellow Brass, Mixing and Melting..... 116

Z

Zinc Alloy for Match-Plates..... 31
Zinc-Coated Parts are Tested, How..... 34
Zinc, Copper, Alloys, Hardness of..... 155
Zinc, Government Prices..... 231

Authors' Index to Volume XLV

January---December, 1917

A

Adam, H., Making Aluminum Match Plates 79
Anderson, Robert J., The Role of Metallography in the Foundry..... 498
Ashe, S. W., Organizing for Welfare Work in Foundries..... 458
Atwater, H. R., How the Sales Engineer Views the Foundry..... 520

B

Backert, A. O., THE FOUNDRY Parallels Iron Industry's Progress..... 372
Baltes, H. A., Repairing a Large Casting by Electric Arc Welding..... 120
Barclay, Harry H., Care to be Exercised in Vibrator Operation..... 249
Bean, W. R., Pulverized Coal for Melting Malleable Iron..... 487
Bell, M. L., and C. E. Nesbitt, Slag Test for Refractory Brick in Steel Industry. 340
Bennett, F. G., Preventing Accidents in Industrial Yards 461
Bowers, B. W., Repairing Cracks in Steel Castings Electrically..... 306
Brook, S. B., Gas as Fuel for Melting Alloys 193
Broughall, E. H., Experiments with Permanent Molds 187, 288
Bull, R. A., Progress of Steel Founding in 25 Years..... 383

C

Capp, J. A., Strength and Elongation of Manganese Bronze 272
Carrick, R., Advantages of Hand and Power Machine Molding..... 285
Carson, George M., Weight of Square Foot of Various Metals.....Data Sheet No. 240, August
Childs, George W., Design for Durable Storage Bins 502
Childs, George W., Standard Foundation Washers.....Data Sheet No. 231, April
Childs, George W., Standard Wood Washers.....Data Sheet No. 232, April
Churchill, W. L., Employment of Female Labor in the Foundry..... 519
Clamer, G. H., Physical Properties of Manganese Bronze 272
Clarke, R. R., Electric-Arc Welding for Foundry Purposes 179
Clarke, R. R., Fundamental Principles of Plate Mounting 147
Clarke, R. R., Troublesome Gating Problem 521

Clarke, Russell R., What Foundrymen Can Do to Prevent Hot Boxes..... 111
Clewell, C. E., How to Solve a Foundry Lighting Problem 522
Coleman, F. A., Average Output of Cupolas.....Data Sheet No. 234, May
Comstock, G. F., and W. M. Corse, Aluminum-Bronze Tests and Their Significance 21
Comstock, George F., Study of Inclusions of Alumina in Steel..... 197
Cook, S. L., Improved Sanding Roll for the Patternmaker's Lathe..... 8
Corse, W. M., and G. F. Comstock, Aluminum-Bronze Tests and Their Significance 21
Corse, W. M., Ten Per Cent Aluminum Bronze 273
Crosby, Edwin L., Solving Electric Furnace Power Problems..... 459
Custer, Edgar Allen, Chilled Iron Balls.. 321
Custer, Edgar Allen, Making Cast Iron Shells in Permanent Molds..... 439
Custer Jr., Edgar Allen, How to Eliminate Sulphur Holes in Castings..... 119
Custer Jr., Edgar Allen, The American Foundry in a Time of War..... 127

D

Dietz, John M., Melting in a Cupola with Bituminous Coal 67
Duggan, M. E., Constructing a Simple Pattern 13
Duggan, M. E., Influence of Design on the Cost of Patterns..... 301
Duggan, M. E., Pattern Design from the Foundryman's Viewpoint 37
Duggan, M. E., Patternmaker's Construction Board 369
Duggan, M. E., Time-Saving Kink for Rush Job 203
Duggan, M. E., Top for the Patternmaker's Work Bench..... 246
Dunbar, Howard W., Do Grinding Wheels Actually Grind? 203

E

Eastham, John H., Pattern Economy in Molding a Fan Pedestal..... 288
Estep, H. Cole, How to Buy Pattern Lumber Economically 117

F

Fletcher, J. E., Influence of Occluded Gases in Cast Metal..... 149
Flinn, Alfred D., and Ernest Jonson, Inspection of Brass and Bronze..... 532
Flinterman, R. F., Electric Furnace in the Steel Casting Plant..... 232
Fraser, A., Heading, Gating and Chilling Steel Castings 304
Fraser, A., Use of Chills in Malleable Iron Practice 303
Fulton, A. M., Modern Methods of Gating Malleable Castings..... 319

G

Goostray, Joseph, Patternmaker of the Hour 162
Gray, C. E., Casting Chilled Car Wheels in a Canadian Foundry..... 297
Greenwood, H. C., and R. S. Hutton, Electric Heating of Crucibles..... 194
Gulick, H. S., Properties of Bronzes for Mechanical Purposes 68

H

Harrington, Joseph, Powdered Coal as a Fuel in Malleable Shops—IV..... 32
Hartley, H., and H. M. Thornton, Melting Brass in a Gas-Fired Cupola Furnace 189
Hering, Carl, Ideals in Melting Metals... 193
Hill, John, Supplying the Foundryman for 25 Years 382
Hocking, W. J., Melting Practice at the Royal Mint 191
Howell, J. J., Control of Cooling Metal in Cast Iron Work..... 302
Howell, J. J., Experiments with Permanent Molds 187, 288
Hutton, R. S., and H. C. Greenwood, Electric Heating of Crucibles..... 194

J

Janssen, W. A., How to Use Titanium in Making Steel Castings..... 15
Jeffery, A. T., Producing Machinable Malleable Iron Castings..... 449
Jones, G. E., Does Copper Affect Shrinkage of Steel Castings?..... 165
Jones, J. L., Aluminum 92 Per Cent and Copper, 8 Per Cent..... 273
Jones, J. L., Conductivity and Hardness of Manganese Bronze..... 272
Jonson, Ernest, and Alfred D. Flinn, Inspection of Brass and Bronze..... 532
Jonson, Ernst, Inspection of Bronze and Brass Castings 154

K

Keep, W. J., All Iron is Good Iron..... 14
Keep, W. J., Bright, Smooth Surface on Castings 79
Keep, W. J., Calculating Tensile from Transverse Strength 445
Keep, W. J., Casting Iron Around a Rigid Center 20
Keep, W. J., Castings with a White Core 130
Keep, W. J., Chill Cracks in Lathe Beds 182
Keep, W. J., Chilled Castings from a Cupola Running Gray Iron..... 188
Keep, W. J., Chilling Mine Car Wheels. 315
Keep, W. J., Cupola Charging..... 93
Keep, W. J., Determining Proper Weight of the Coke Bed..... 132
Keep, W. J., Different Kinds of Iron.... 82
Keep, W. J., Early Stove Manufacture in the United States..... 247
Keep, W. J., Early Types of American Heating Stoves 336
Keep, W. J., Figuring the Cost of the Cupola Heat 102
Keep, W. J., Gray Iron Progress in 25 Years 374
Keep, W. J., Hard White Iron for Pipes. 502
Keep, W. J., Heat-Resisting Gray Iron.. 14
Keep, W. J., History of Nickel Plating for Stove Decorating 175
Keep, W. J., How to Make Chilled Cast Iron Balls 288
Keep, W. J., How to Prevent Dull Iron. 318
Keep, W. J., Influence of Impurities on Tensile Strength 457
Keep, W. J., Limestone for Cupola Flux. 118
Keep, W. J., Loss in Melting..... 178
Keep, W. J., Losses in Melting Cast Iron 222
Keep, W. J., Mixture for Cylinders..... 202
Keep, W. J., Mixture for Stove Castings. 452
Keep, W. J., Preventing Cupola Bridging 310
Keep, W. J., Remelting Shot Iron..... 52
Keep, W. J., Semisteel Castings..... 248
Keep, W. J., Slow Melting and Bridging 97
Keep, W. J., Strong Castings..... 165
Keep, W. J., to Increase the Melting Capacity of a Small Cupola..... 291
Keep, W. J., to Reduce Combined Carbon 47
Keep, W. J., Varying Strength in Different Parts of a Large Casting..... 305
Kent, J. F., Labor Appreciates the Human Element 524
Kihn, William J., Casting Floor Plate and Bed for a Boring Mill..... 491
Kihn, William J., Molding and Coring a 5-Ton Gear Cutter Bed..... 363
Knoeppel, C. E., How Profit-Sharing Has Worked in Foundries 6
Kreutzberg, E. C., Making Gray Iron Art Work 85

L

Lamont, Robert P., Progress in the Manufacture of Steel Castings..... 328
Later, E. P., How Zinc-Coated Parts are Tested 34
Later, E. P., Increasing the Output of the Plating Room..... 261
Later, E. P., Intelligent Use of Nickel-Plating Solutions 333
Later, E. P., Protective Coatings: Japans and Enamels—II 138
Later, E. P., Protective Coatings: Lacquers—I 103
Later, E. P., Safety in the Plating Room 58
Leafstrom, John, Influence of Design on the Cost of Patterns..... 33
Lorenz, A. Walter, Castings from Acid and Basic Electric Steel.....220, 269

Mc

McCaslin, H. J., Shrinkage and Contraction 5
McKee, W. S., Manufacturer of Manganese Steel Castings..... 141
McLain, David, Production of Semisteel Shells 337
McLain, David, Semisteel in the last Quarter Century 384
McLain, David, The Properties of Semisteel Castings 53
McNaughton, M., How the War Affects Manufacture of Crucibles..... 494

M

Meneghim, Domenico, Hardness of Copper Zinc Alloys 155
Moldenke, Richard, Casting Malleable Iron in Permanent Molds 40
Moldenke, Richard, Malleable Foundry's Quarter Century Survey..... 380
Moldenke, Richard, Seasoning of Castings 96
Moldenke, Richard, Shrinkage of Malleable Cast Iron 19
Moore, Frederick C., A Cost System for a Small Malleable Foundry..... 9
Muntz, G., and E. Roubien, Study of the Steel Foundry Sand Problem..... 312

N

Near, N. G., Strength of Chains.....
.....Data Sheet No. 239, August
Nesbitt, C. E., and M. L. Bell, Slag Test for Refractory Brick in Steel Industry 340
Newcomb, Robert E., Solving Foundry Transportation and Conveying Problems 535

O

Olmstead, G. C., Economical Radiator Cores 462
Orbison, J. B., Cast Iron Balls for Grinding Mills 14
Outerbridge Jr., Alexander E., Early Use of Permanent Molds for Castings..274, 398
Outerbridge Jr., Alexander E., How Gray Iron has "Grown" in 25 Years..... 379

P

Pack, Charles W., Evolution of the Die-Casting Process 237, 265
Palmer, R. H., Molding Wheels and Sheaves with Steel Spokes..... 99
Palmer, R. H., Propeller Casting is Essential to Our Defense..... 366
Patch, N. K. B., Properties of Manganese Bronze 272
Patch, N. K. B., Properties of the 80-10-10 Alloy 272, 311
Penton, John A., How THE FOUNDRY was Dressed When It Made Its Bow 25 Years Ago 370
Perkins, F. M., Pattern Shop and Foundry Organization 48
Pero, J. P., Progress in Malleable Iron Manufacture 377
Pope, Henry F., Malleable Iron and Its Uses 505
Primrose, H. C., Melting in a Crude-Oil Furnace 194

R

Ramp, Paul R., Sensible Flask Equipment for Machine Molding..... 76
Ramp, Paul R., Use of Cast Iron Molds and Cores 164
Roubien, E., and G. Muntz, Study of the Steel Foundry Sand Problem..... 312

S

Sawhill, R. V., Melting All-Scrap in Electric Furnace 399
Scovell, Clinton H., Essential Factors in Foundry Cost Accounting..... 90
Shaner, E. L., Making Cook Stoves for Uncle Sam's New Army..... 389
Shaner, E. L., Making Nonferrous Castings in a Railroad Shop..... 1
Shea, J. F., Specifications for Wood Patterns 269
Sherwin, L. M., Effects of Seasoning on Gray Iron Castings..... 435
Shull, F. G., Recently Developed Uses of Aluminum in Industry..... 531
Stevens, Frederic B., Growth of the Foundry Supply Business 378

T

Thornton, H. M., and H. Hartley, Melting Brass in a Gas-Fired Cupola Furnace 189
Tonkin, E., Measuring Furnace Oil Without Using a Meter..... 202
Tonkin, E., Time-Saving Stand for Checking Melting Losses in a Brass Foundry 20
Touceda, Enrique, How Malleable Iron Has Improved 475
Touceda, Enrique, Malleable Iron Improves in Quality 376
Townsend, C. D., Boilers Reclaim Melting Furnace Heat..... 525

V

Vickers, Charles, Difficult Bronze Casting Molding Job 234
Vickers, Charles, Electric Furnace as a Copper-Melting Medium 280
Vickers, Charles, How We May Conserve Our Metal Resources 209
Vickers, Charles, Some Test Bar Suggestions for Nonferrous Metal..... 322
Vickers, Charles, What the Brass Foundry Has Done in 25 Years..... 386

W

Wallbank, E. W., A Quick Method of Making a Gear Cover Casting..... 146
Watson, E. L., Pattern Lumber Selection 205
Webbert, L. P., 88-10-2 Alloy..... 271
Wesson, Major C. M., Steel Castings for Ordnance Construction 453, 447
Whiting, J. H., Progress in Foundry Equipment Manufacture 375